Mining Journal

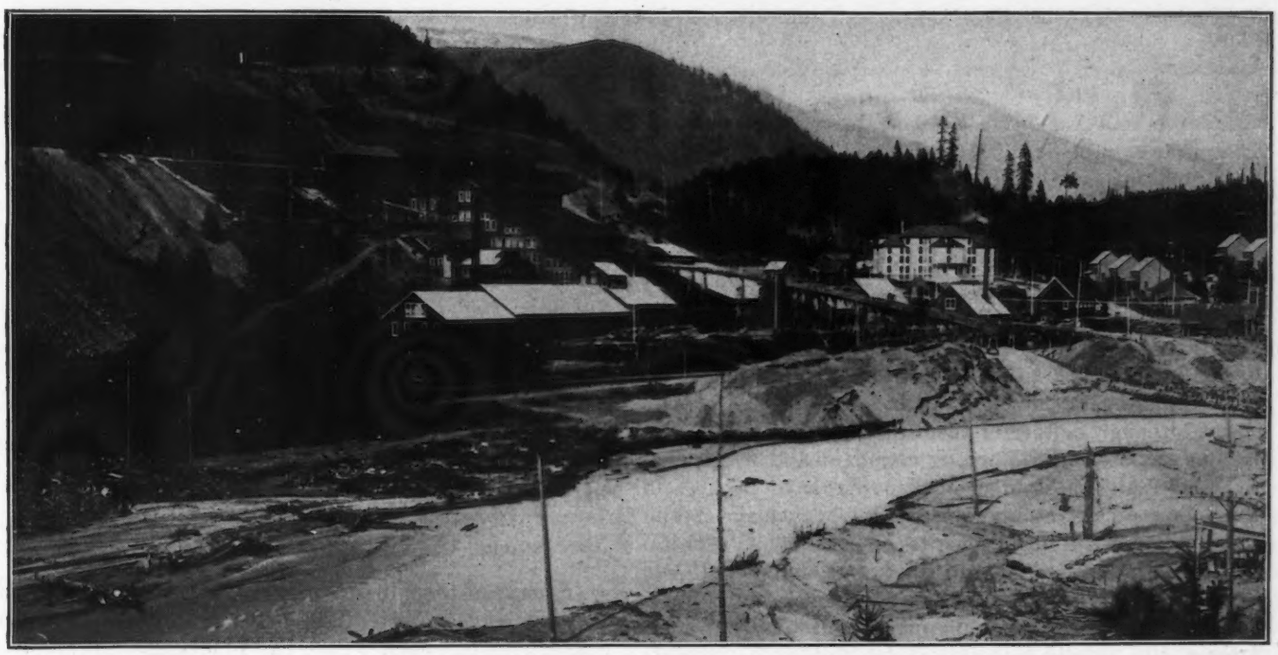
VOLUME 100 NOVEMBER 20, 1915 NUMBER 21

Metallurgy in the Coeur d'Alenes

By Herbert A. Megraw

SYNOPSIS—The ores of the Coeur d'Alene district are varied and complex and have been difficult to treat economically. Their fine structure and the presence of blende and siderite induce serious metallurgical problems. Flotation has been of great assistance in aiding metal recovery from finely ground pulp.

The metallurgical problems of the Cœur d'Alene district of Idaho are varied. The variation is in extent rather than character. Many of the mines produce ores that present only the simple problem of extracting the greatest quantity of commercial metals at the lowest cost, while others, producing ores of highly complex mineralogical character, involve not only the extraction problem, but that of separating the various minerals contained. Upon these problems all the metallurgical plants of the district are working intently and with a degree of success depending largely upon the character of ore to be handled.



THE MORNING MILL, AT MULLAN, WHICH CONTAINS A WIDE VARIETY OF CONCENTRATING MACHINERY

The Metallurgical Problem Not a New One

In considering the metallurgy of the Cœur d'Alenes it may be well to remember that the district is not a new one, but one in which the problems have been attacked over a period of a number of years. Metallurgical skill of a high grade has been employed, and all the successes obtained have been truly earned. With these facts in mind it is clear that any suggestion of improvement ought to be based on careful study of the facts at hand. It would be rash to make superficial observations regarding possible improvements.

The principal part of the Cœur d'Alene district is in Shoshone County, Idaho, in the narrow part of that state, between Washington and Montana. It is near the Montana border and in fact extends close to the state line. There are even one or two properties over the line in Montana. The productive part, however, is principally on the west slope of the Cœur d'Alene Mountains, a rather complex part of the North American Cordillera. The geology, topography and general features of the district are so well known that any review of them here would be entirely superfluous. It is sufficient to say that the structure of the region is complex and that the ores present a great many obstacles to successful metallurgy. This statement ought to be modified to the extent of saying that some of the mines produce ores that are fairly simple and in which one metal will so predominate that all energies are bent toward its recovery. But in other cases the ores are complex and great pains have to be taken, not only to recover the commercially

valuable metals, but to separate them after or during the recovery process.

According to the more careful studies already made, both by the United States Geological Survey and by the companies operating in the district, it has been shown that a large number of metals and minerals exist. Gold and silver have both been found in the native form, but the former is rare in that or any other state, and its recovery has not been found commercially profitable on a large scale. Where found, it is in quartz veins in which some free gold occurs together with auriferous pyrite, chalcopyrite, galena and sphalerite. Native silver was found in the upper levels of some of the mines, particularly in the oxidized ore of the Last Chance mine and in the Hercules. In the lower levels, however, silver is found in combination with lead and with zinc, but its quantity is such that the recovery of the other metals is an essential to the profitable operation of the properties. It is in view of this latter fact that highly developed metallurgy has become an important factor in the life of the district, since it is well known that lead and zinc must be separated if either is to be counted as an asset.

Among the minerals occurring in the Cœur d'Alene ores, galena should be mentioned first, since it is the most important mineral in the district, being a source of the large production of lead and the medium that carries a great part of the silver. It is probable that galena is the most widely distributed mineral in the district, with the possible exception of pyrite. The sulphide of antimony (stibnite) is not rare. It is common in the Wardner district. It forms in small needles or clusters in quartz or, more rarely, in siderite. Chalcocite is found occasionally, but like the antimony, is comparatively rare. Sphalerite, the well-known zinc mineral, is found rather widely distributed, but in quantity not so great as might be expected in view of the great quantity of galena. Sphalerite seems to be more abundant in the mines in Ninemile Cañon and in the neighborhood of Mullan, where it occurs in the Morning mine and considerably complicates the treatment at the mill. Pyrrhotite has been found in Cañon Creek and Ninemile Creek. There is a little of it also in some of the ores from the Morning mine. Both bornite and chalcopyrite occur, although neither of them in large quantities. Pyrite, as has been mentioned, is abundant and widely distributed. All the lead-silver deposits have it, and in the poorer ores it occurs without any valuable metal in combination with it. Proustite occurs seldom. Tetrahedrite occurs sometimes and has been noted at the Gold Hunter and in small quantities at the Morning mine, near Mullan. It is said to contain antimony but little arsenic, and usually to be in combination with considerable silver.

Influence of Siderite on the Metallurgy

Among the oxides may be mentioned quartz, the most abundant in many of the mines and occurring in all the ore deposits. Magnetite occurs occasionally, as do also limonite and plattnerite, the latter a rare form of lead dioxide. Among the carbonates, calcite is not common, but occurs, as does also dolomite. Siderite, the carbonate of iron, is the most abundant characteristic gangue mineral of the Cœur d'Alene silver-lead deposits. Its presence as a replacement of quartzite constitutes a striking mineralogical feature of the ores. This siderite is one of the most important features of all the Cœur d'Alene ore constituents, and any system of metallurgy must be based upon a thorough cognizance of that fact. It is by no means equally abundant in all the mines, but is prominent in the ores of the Wardner and Mullan group. There are a large number of other minerals that occur in the various ores, all of which tend to complicate the metallurgy of the material. The principal ones have already been mentioned, but the other rarer minerals, which undoubtedly have an influence upon the methods of ore handling, are explained at length in Professional Paper No. 62 of the Geological Survey, to which those who desire further detailed information upon the subject are referred.

Siderite has an important influence upon the handling of the metallurgical problems presented and has been given careful attention and study by the operators of the district. In the paper already referred to, the typical Cœur d'Alene siderite is described as massive, a pale-brown fine-grained aggregate, being not always distinguishable at a casual glance from the quartzite that it has in part replaced. Near the orebodies all gradations exist between nearly pure siderite and a somewhat sericitic quartzite.

The character of the siderite of the Cœur d'Alene district is considered so important in connection with its metallurgical problems that it seems worth while to include the following paragraph by F. C. Calkins in the Geological Survey paper mentioned.

> **Siderite occurs in individuals of varying size, but probably the majority of them are larger than the clastic grains of the rock, the mineral being in places crystallographically continuous for a diameter of several millimeters. The form of the individual varies much in regularity. The outlines of many of them, especially of the larger grains, appear ragged, but in such cases the boundaries are seen on close examination to be determined in large part by rhombohedral planes. In other individuals the rhombohedral form of the crystal is more marked, in some being perfect. It is an important fact that in any specimen the crystallographic boundaries can be seen cutting sharply across quartz grains, which proves that the siderite has been developed by molecular replacement of the quartz and not by filling in of cavities. The larger grains in the sandstone and quartzite frequently inclose grains of quartz and, much less commonly, scales of sericite. It is thus evident that the siderite replaces the sericitic fine-grained cementing material more readily than the larger grains of quartz.**

A knowledge of the characteristics and formation methods of this mineral will be of great importance in considering the question of ore treatment.

Silver and Lead the Principal Products

In many of the mines there have been large productions of silver and lead from the oxidized galena, which has changed to cerussite. This has practically disappeared, however, at the present time, and the essential lead and silver production is from galena. This mineral occurs in many forms, varying from fine-grained to massive, but is always argentiferous, although the ratio between the lead and silver varies in the different parts of the district. In many of the mines some of the galena occurs so nearly pure that it can be shipped directly without milling, but of course the quantity thus obtained is of no consequence in comparison with the milling production of the district.

The ores are treated in a number of milling plants situated in different parts of the district. The mills now in operation do not include all of those that have

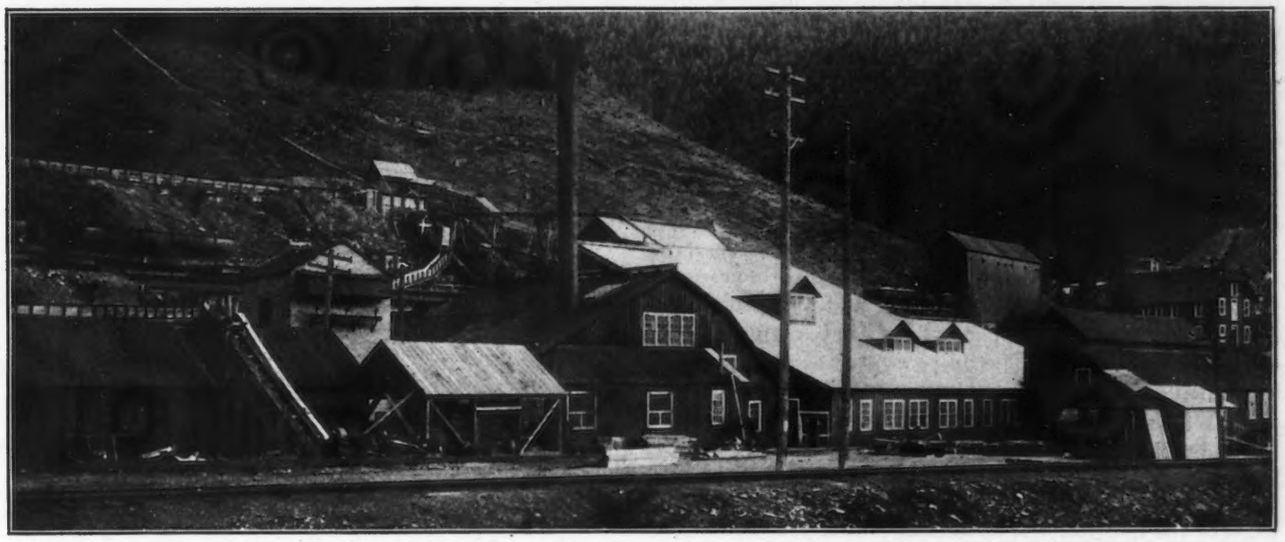
existed in the history of the camp, since some of them have disappeared. The National and the H.E.M. are new. The former is a modern all-slime table and flotation mill, designed and constructed to work the ores of the National mine, but is not yet in operation. The H.E.M. mill has just been completed.

It is a characteristic feature of the Cœur d'Alene district that the mines in different parts produce ores of widely different character. The Bunker Hill & Sullivan mill, at Kellogg, treats a lead-silver ore that is characteristically simple. It consists principally of galena and siderite, there being only minute portions of sphalerite and pyrite. The ore is treated in a series of rock crushers in a separate crushing house and is then delivered over an incline belt conveyor to the mill bins. It is separated by trommels and then concentrated in Harz jigs. Both rolls and Hardinge mills are used for regrinding and Bunker Hill screens for reclassifying.

Card tables are used for concentration, and vanners handle the slimes. The slimes tailings are thickened in Dorr thickeners and then sent to the flotation department for further treatment. The whole object of milling treatment at the Bunker Hill is to produce only high-grade material in concentrates. The middlings are all reground and returned until a high-grade product is secured. This extends also to the flotation department, in which cleaning and recleaning are resorted to until a high-grade shipping product is secured.

course, is patterned after the standard of the district in which rolls, jigs and concentrating tables are used. But there are interesting additional features. There is here one of the few installations of Macquisten tubes. These are designed to make a flotation separation, taking advantage of the tendency of the sulphides to float upon the surface of water when they are gently deposited upon it. The principle is well known, but the plants making use of it are few, there being only two, so far as is known, in the United States. At the Morning mill the process is considered an important step in mill treatment and operates satisfactorily. In addition, a system of froth flotation is also used.

At the Gold Hunter mill, above Mullan, conditions are somewhat similar in that the ore is quite complicated. Besides galena, it contains sphalerite, pyrite, tetrahedrite, stibnite and the gangue materials, siderite, calcite and quartz. The treatment is after the standard system, using rolls, trommels, jigs, tube mills and concentration on Wilfley tables. Flotation is used on the slime tailings, and the flotation concentrates are filtered in an Oliver filter. At the Hunter mill, flotation has been a very considerable aid in the metallurgy of the ore. The Callow flotation machines have improved the mill recovery from 50 to 60%, as obtained by ordinary concentration, to 80%, the concentrates containing only about 6% of silica.



HECLA MILL, NEAR GEM, IDAHO, TREATING ONE OF THE SIMPLER ORES OF THE DISTRICT

Complex Ores at the Morning Mill

At the Morning mill, situated just below the town of Mullan, the conditions are noticeably different from those obtaining at the Bunker Hill. The ores are essentially complex, and their treatment is difficult. Galena, the principal ore in all the mines, is here associated with sphalerite, pyrite and pyrrhotite. Siderite, the principal gangue, is accompanied by barite and quartz.

The Morning mill, one of the reduction plants belonging to the Federal Mining and Smelting Co., is one in which all kinds of treatments have been tried in an effort to get the best possible recovery from the ore, and in consequence it contains a widely diverse assortment of machinery. The straight concentration treatment, of

The Hercules mill, just below Wallace, has been treating an ore consisting principally of galena. At present the mill is not in operation, there having been some difficulty in making smelting arrangements. It is said that the company has acquired an interest in the Northport, Wash., smelting plant, which is being equipped with lead furnaces and will be used for treating Cœur d'Alene ores. The Hecla mill, near Gem, is another which has an ore of simple construction. The main mineral constituent is galena, and there are only small quantities of sphalerite and pyrite. The ore is treated by the usual combination of jigs and tables, followed, as is now common in the Cœur d'Alene district, by a flotation installation for handling the mineral in the slime tailings. The Hecla mill handles the ores with considerable success and accomplishes a material saving of the contained values.

The Green Hill-Cleveland and the Stewart mills, in Wallace, are both operating after the characteristic system of the district. At the Green Hill mill a large number of experiments in ore treatment have been tried and a large number of flotation tests have been put through. Flotation forms a part of the treatment system here, as in the other mills of the district. Both mills are the property of the Federal Mining and Smelting Co., but the Stewart is under lease to the Stewart Mining Co.

The Frisco mill treats ore that is complicated, since it contains galena, sphalerite, pyrite, chalcopyrite, pyrrhotite and some quartz. It is to be noted that the ores treated at the Frisco mill, as well as those at the Hecla, are noticeably deficient in siderite, a fact that contrasts the treatment with most of the other mills in the district. At the Hecla mill the treatment is simple and easy, but at the Frisco the ore itself is complicated and preparation is not so easy. The general treatment seen at the Frisco mill is that of the standard practice of the districts, which has already been described.

An extremely interesting mill now at work is the Interstate, in Ninemile Cañon, which is treating ores of the Interstate-Callahan Mining Co. This mill is a new one and was prepared for operations just about the time the rise in the price of zinc began. This company took advantage of the situation and, since its product is largely zinc, has made a great deal of money through the operation. The treatment system is the standard crushing, jigging and table concentration system followed in the district, with the addition of a flotation plant for the treatment of the slimes. Other mills working in the same cañon are the Success and the Tamarack.

The National mill, at National, has just been completed and is a modern all-slime table and flotation plant, designed to treat the copper ores of that section of the Cœur d'Alene district. The mill was started and operated successfully, but for some unknown reason has been shut down for some time. Another mill now operating, which has not been described, is the Sweeney mill, at Sweeney, the property of the Federal Mining and Smelting Co. The practice in use there is the same as at the principal mills of the district. The Success, Marsh and Tamarack & Custer are other mills now in operation.

Metallurgical Problems of the District

The principal problem in Cœur d'Alene metallurgy, in common with any metallurgy anywhere, is the separation of the minerals from the gangue. With the simpler ores of the district there has been no great difficulty with this problem, since all that is necessary is a moderate degree of crushing to enable the minerals to be isolated. The separation is accomplished by means of jigs and concentrating tables, usually giving good results. The problem occurring in former times was one principally of handling the slimes produced in the normal course of crushing. The character of the minerals (galena, siderite, etc.) tends perceptibly toward brittleness, and therefore much slimed material was produced in the crushing process. It was formerly handled by slimes tables or vanners when it was handled at all, but the recovery was not all that could be desired. The introduction of flotation has been of great assistance to this step in the metallurgy, making it possible to recover much more of the minerals contained in the slimes.

In the cases where the gangue is principally siderite, the separation of this material from the minerals desired is not so easy. Siderite is an iron mineral itself, and in the rough concentrating processes it is likely to remain largely with the lead and zinc minerals, since its specific gravity is nearly the same as that of blende. In such cases recrushing and stage concentration were necessary. The usual process is to concentrate first, giving a clean mineral, a clean tailing and a mixed middling. The last is then recrushed and reconcentrated, the process being repeated several times until the amount of middling is so small as to be negligible.

After the separation of minerals from gangue, the great problem is in the separation of the lead and zinc. The only way in which this can be accomplished is by repeated step concentrations and regrinding of middlings. Here the flotation process has been of immense assistance, since it enables the successful concentration of minerals ground to an extreme state of fineness—a material that would have been unmanageable under the conditions obtaining a few years ago.

Influence of Microstructure on Metallurgy

Among the complex minerals of the Cœur d'Alene district, there are some in which the ore structure is so complex that successful concentration results are not possible. In many cases the character of the ore is identical with that of ores of extremely high grade, and in many cases the assays show so much value that it might be supposed that a slight degree of concentration would produce concentrates of salable grades. A study of the structure of the ores, however, shows that they are no better than waste. The galena, pyrite, siderite and sometimes chalcopyrite are variable and sometimes extremely complex. The problem hinges entirely on the microstructure of the ores, since there are fine inclusions of ore minerals in gangue. Under the microscope the essential and characteristic feature is the distribution of multitudes of microscopic specks and threads of galena and siderite as inclusions in a mass of nonmetallic gangue. The galena is held in microscopic threads and specks as inclusions in the siderite gangue. This fine dissemination compels extremely fine crushing and complicates the metallurgy. In many cases the intermingling of the minerals is so finely grained as to be microscopic, making it altogether impossible to crush fine enough to allow a separation of the two minerals. It is possible, however, to improve the extraction with the finest of grinding, and it is upon this point that flotation has come to the aid of metallurgists and allowed successful handling of these materials ground to an extreme state of subdivision.

Japanese Sulphur Industry

The export of sulphur from Japan has for years been on the decline, some of the small mines having been compelled to stop working. But since the war broke out, the demand in the foreign market has improved and quotations have gradually risen. The export this year up to the end of August, according to the *Japan Advertiser*, was 27,948,607 lb., valued at $203,048, showing an increase of 4,638,451 lb., compared with the figures for the corresponding period of last year. The destinations have in the past been the United States and Australia in the

main, with Canada and India coming next, only an insignificant amount being shipped to Europe. Since the war, however, the European supply to Oriental countries has been stopped and the demand in Europe itself has increased.

Mineral Output of New York

The mineral production of New York in 1914 is given as follows in a report on the mining and quarry industry of the state, by David H. Newland, assistant state geologist: Cement, portland and natural, 5,899,804 bbl.; salt, 10,389,072 bbl.; natural gas, 8,714,681,000 cu.ft.; iron ore, 751,716 long tons; gypsum, 513,094 short tons; petroleum, 933,511 bbl.; mineral waters, 8,480,669 gal.; talc, 74,075 short tons; pyrite, 61,513 long tons; graphite, 2,483,339 lb.; garnet, 4,026 short tons; feldspar and quartz, 2,375; metallic paint, 7,321; crude clay, 7,109; emery, 763 short tons. Other mineral substances, including limestone, sand and gravel, sandstone, granite, marble, apatite, diatomaceous earth, etc., to the value of $8,164,810 were also produced.

The production of iron ore showed a marked decline from that of the preceding year, which was 1,217,899 long tons. Other changes were not large, except in the case of salt, which declined about 430,000 tons, and talc, which increased about 11,000 tons.

Advance in Chemical Prices Due to the War

The Boston *Transcript* has compiled a table showing the advance in chemical and drug prices caused by the war. From this table some of the chief inorganic items are reprinted here.

CHEMICAL PRICES

Material	June 1, 1915	Nov. 5, 1915
Acetate of lime, cwt.	$2.50	$14.50 @ $14.55
Acetic acid, U. S. P., lb.	$0.04½ @ .05	.07½ @ .08
Alum, potash, cwt.	3.50 @ 4.00	6.25 @ 7.00
Arsenic, red, lb.	.07¾	.19 @ .20
Bichromate of potash, lb.	.16	.24 @ .25
Bichromate of soda, lb.	.06	.17 @ .18
Bromine, lb.	.82	5.00 @ 5.50
Chrome alum, lb.	.08	.21 @ .23
Lead acetate, lb.	.10½	.13 @ .13½
Magnesium chloride, ton.	$32.00 @ 36.00	75.00 @ 80.00
Muriate of potash, ton.	155.00	300.00
Permanganate of potash, lb.	.65	1.25 @ 1.50
Prussiate of potash, red, lb.	.70	4.25 @ 4.75
Prussiate of potash, yellow, lb.	.53	.80 @ .85
Zinc dust, lb.	.16 @ .16½	.35 @ .40

Mining in India in 1914

The Chief Inspector of Mines in India has just issued his annual report for 1914. In addition to information regarding persons employed, accidents, health and sanitation, the following figures of output are given: Mica, 38,189 cwt.; manganese, 555,672 long tons; gems, 304,042 carats; gold, 19,873 oz.; copper, 4,400 long tons; wolfram, 31,526 cwt.; bauxite, 9,280 cwt. Iron, slate, fuller's earth, salt, chromite, magnesite and other minerals were produced, but the quantity is not stated.

It should be noted that this report does not give a complete review of mining in India, but confines itself to those mines and quarries coming under the scope of the Indian Mines Act of 1901, which excludes quarries under 20 ft. deep. The complete figures are given in the records of the Indian Geological Survey.

Mining Methods at Braden*

"El Mineral Teniente" property of the Braden Copper Co. at Rancagua, Chile, is situated on the rugged slopes of a part of the main Andean Range in latitude 34° south and longitude 71° 20′ west, at an altitude of about 8,000 ft. The mine is a very old one, dating its history, as stated by William Braden[1], back to the Eighteenth century. The mine operations up to 1906 were on a very small scale and consisted of a gopher system of mining rich veins, concentrating by hand sorting, and transporting about 15 mi. by mule-back for direct smelting. At that period the operations of the American company commenced in earnest, and from that time on the mine has gradually been enlarged, until it has attained its present 3,000- to 3,500-ton daily output.

The deposit consists of a series of irregular lenses formed about the periphery of an old volcanic plug slightly tilted to one side. On one edge the surface has been eroded and has lost its mineral completely; for active mining operations about four-fifths of the circumference of the crater is left. The volcano itself would rank as a fairly large one, having a diameter of about ¾ mi. and a roughly circular outline about 2½ mi. long. The country about the mine consists of andesite flows through which the tuff plug now occupying the crater was forced.

Brecciation Favorable to Ore Deposition

The materials close to the volcanic center were so thoroughly shattered that they formed a brecciated deposit, making a most favorable point of deposition; and it is in the brecciated portions of the lenticular orebodies that the richest ore is found. The mineral sulphides, however, formed ore in the andesite at some distance from the crater. Generally speaking, the materials with which the mine is interested are the tuff composing the volcanic plug, the breccia, and the andesite composing the country rock. As a rule, the tuff is not mineralized except close to the breccia contact or at such points as fumarolic vents have been formed. The actual contact between the tuff and breccia is not always distinct, but the former includes rounded fragments of porphyry and the latter, angular fragments of andesite, which makes the difference easy to detect.

The contact between breccia and andesite is easy to note as a rule, but on the Teniente side the gradation from shattered andesite to andesite breccia is a most perplexing one. The breccia does not always appear as an intermediate material between the tuff and the andesite, but on the tuff-andesite contact the ore is not so rich nor the width so great. At various places in the mine old fumaroles are encountered in which oxidation has taken place at depth, and at times small chambers containing heads of wire copper coated with oxide are found in company with the usual black sulphides and oxides and yellowish iron stains of limonite.

The limit of ore on the crater side is generally the tuff, although sometimes false contacts—thin tongues inserted into the breccia—occur, on the inside of which there is good ore-bearing breccia. On the country-rock side the limit of ore has to be determined by assay, but is also detectable by the lessening of the fractures and the blockier appearance of the andesite.

*Excerpts from article by H. R. Graham in "Teniente Topics," Sewell, Rancagua, Chile.

[1]"Eng. and Min. Journ.," Sept. 4, 1915.

The copper ore occurs in both breccia and andesite, essentially as primary sulphides in the form principally of chalcopyrite, as bornite, as secondary chalcocite, a black sulphide between tetrahedrite and enargite and some of the carbonates, silicates, sulphates and oxides of copper. Zinc blende, iron pyrites, magnetite, galena and occasionally native copper are also found.

The topography of the region is steep and rugged, devoid of vegetation, frequently visited by strong winds, heavy snows and snow-slides. This topography aids mining, drainage and ventilation by allowing the mine to be opened by adits, but makes difficult its operation by the lack of safe room for buildings and storage of supplies and by the difficulty of access.

On the upper levels of the mine live between 500 and 800 people, who are housed either in large rooms cut in the rock or else in wood and *calamina* houses perched on the hillsides.

The Mine Development

The mine consists of three principal orebodies—the Fortuna, the Regimiento and the Teniente—with a total reserve of about 90,000,000 tons, developed and probable, with good prospects for largely increasing this tonnage by future development. The two smaller orebodies, of secondary importance but included in this tonnage, are the Centinela and the Bornite. The Teniente orebody is now being developed to an operating stage. The full extent of ore in this section has not as yet been determined.

The Fortuna orebody, from which all the ore at present is being won, is operated by the principal levels, where, with the exception of three, shrinkage stoping operations have been nearly completed and caving is now in progress.

Development consists of driving adits along the contact of the tuff and breccia or andesite. Once the ore is reached, crosscuts are put in about every 34 m., and in this way, blocking out every 100 ft., the plan area of the ore at that level is determined. The extent of ore was first determined in the Fortuna on the No. 2 level, then blocked out on the No. 3 level in the same manner, and the ore between them proved up by inclined raises running from the tuff to the limit of commercial ore and back, to ultimately connect to the level above. The tuff is on the hanging wall.

After a block of ore is outlined the crosscuts used in developing the body are utilized as starting points for the actual mining operations. In these crosscuts small raises, at from 7- to 8-m. centers, are driven up into the ore at 45 deg. until the face of the raise reaches the far side of the stope. In some cases this is 10 m. on the incline in the old system; in the present Teniente system it will be about 5 m. When this drive is completed, a timber chute with an arc gate is erected. A machine of the standard stoper type is put to work, and these various raises are connected, one to the other, by a belling-out process, which ultimately leaves a series of circular holes. These at last extend across the orebody.

In the meantime, in the pillar left between each two of these sets of openings an inclined raise has been driven, and at a point about 12 m. vertically above the level a horizontal working known as *cruzado* is driven from the raise to a stope formed by the joining of all the chute holes. The width of this stope, depending on the kind of rock, is generally 22 ft., and the length, dependent on the width of the orebody, varies from 60 to 350 ft.

Once the *cruzado* is connected, the chutes are allowed to fill up with broken ore, after which all communication between stope and level is by these *cruzados*. The stope is filled with broken ore to within 6 to 8 ft. of the back and then trimmed into shape by means of carefully placed holes put in by the hammer drills. Pipe lines are run up the inclined manway raises to supply air for the operation of the drills and to the rooms for ventilation. Once the stope is "lined up," machine drillers start work in the ratio of about one drill to every 40 ft. of stope length. An average drill shift consists of fifteen 5-ft. holes per machine, which should break, with 1½ sticks of ordinary 34% gelignite per hole, about 60 tons of average stope rock. On the principle that each cubic meter of rock in place occupies 1¾ cubic meters when broken, it is possible then to draw out 24 tons for each 60 tons broken and leave the same distance of 6 to 8 ft. between the unbroken back and the broken ore pile.

Stoping and Caving

No holes are drilled in the center of the stope, but each drill from the extreme wall drills one vertical hole and one slightly inclined hole toward the center of the stope. Then at a 5-ft. distance, the miner drills two more similar holes and continues thus until his shift is over. By alternating this process from one side day shift and the other side night shift, a great deal of rock in the center of the stope is robbed of its side supports and has to fall by itself, which tends to cheapness. All stope work is done on contract price per foot of hole. Additional men are employed to deliver steel to the stopes; mechanics repair machines and keep air lines in shape; and on the level below, trammers continually draw off the excess break to leave the working space necessary between the back and the ore pile.

This stoping operation goes on until the back reaches a point 30 ft. below the level above, at which point a final blast to fill the stope is fired and the work discontinued. The raises in the pillars are continued to connect to the level above for ventilation, and as one pillar raise is run in the hanging-wall end and in the next pillar in the foot-wall end, each stope always has at least two entrances and a continuous natural ventilating draft. The drillers load and shoot their own rounds; each shift at 15 min. before quitting time has all its holes ready to spit. When the raising is finished, the stopes are left filled until caving operations above have been completed.

The best arrangement of stopes as developed here, to suit the ground, is to have a 7-m. stope and a 5-m. pillar, which, in the case of bad ground, can be changed by narrowing up the stope and increasing the pillar without having to change in any way the level workings. Chutes are best spaced about 7-m. centers, and it has been found by experience that 50-m. differences in elevation between levels make stopes most easily worked. Each stope has its crosscuts immediately under it and running parallel to it, that is, across the width of the orebody.

In the beginning of operations no timber except chute sets and a slight amount of material for crossings and station sets is needed, but when stoping operations cease and caving begins, more timber is necessary to hold open the haulage drifts. As the whole success of caving depends on the superincumbent pressure that can be brought to bear on the unbroken pillars, it is necessary to secure weight as quickly and as evenly as possible, and that means heavy ground on the haulage ways. These ways then have to be timbered, relieved, caught up, angle-braced and kept in repair.

The process of caving consists of cutting off the pillar at the foot wall and hanging wall by means of small stopes, or by running raises in which large blasts are fired, either electrically or with fuse, and then by running a pillar drift along the bottom of the pillar immediately above the level and blasting a series of pits here, the pillar is completely cut off and has to fall. If by any chance it tends to arch, this arch is broken by a heavy blast. The material resulting from the chute blasting is pulled out and the pillar caves down.

The most important consideration is the securing of even weight and then an even pulling so that the extraction is not spoiled by waste admixture. Definite data are kept on each chute; its expectancy above the level is figured and its extraction calculated when waste definitely appears. Careful chute sampling is done on the caving level, and chutes running below commercial grade are abandoned unless it is known that the chute has ore above it. In case there is known ore above and the waste is merely a little fine material that has sifted through, the chute is run, the material sent to waste and samples taken until it runs ore again.

Nevada Consolidated Report

Nevada Consolidated Copper Co. reports for the third quarter of 1915 a production of 18,516,121 lb. of copper, divided as follows: July, 6,292,413 lb.; August, 6,201,858 lb.; September, 6,021,850 lb. During the quarter 837,374 dry tons of Nevada Consolidated ore, averaging 1.66% copper, was milled, a decrease of 11,781 tons from the previous quarter. Of the tonnage milled, 98% was supplied from the pits and 2% from the underground workings of the Ruth mine. In addition, 29,681 dry tons of Giroux Consolidated ore was milled. The cost of copper produced, including Steptoe depreciation and all charges except ore extinguishment and after crediting all miscellaneous earnings, was 8.01c. per lb., as compared with 8.93c. for the previous quarter. The earnings for the quarter are computed on the basis of 15.876c. per lb., and all unsold copper on hand and in transit is carried in inventory at 13½c. per lb. Gross earnings for the quarter were $1,590,621. Depreciation of plant and equipment was $143,879; ore extinguishment, $84,593; and $749,796 in dividends were paid, leaving a net credit to earned surplus of $612,352. At the pits 866,713 cu.yd. of overburden was stripped during the quarter. Work was also actively continued in preparing the Ruth mine for underground operations, with the result that at the end of the quarter the hoist and underground trolley were running smoothly, the living quarters were about finished, and it was expected that all of the surface work with the exception of the installation of a larger air compressor, already ordered, would be complete by the end of October.

Earth Tremors on the Rand

By A. Cooper Key*

Johannesburg has been experiencing earth tremors lately. No serious damage has been done to buildings, but in some cases cracks have developed and the question of insurance against damage is being discussed. The subject of causation and prevention of tremors is being investigated by a committee consisting of R. N. Kotze, government mining engineer; R. A. T. Innes, Union astronomer; and David Wilkinson, consulting engineer of S. Neumann & Co., mining financiers.

In the year ended June, 1911, there were 19 tremors; to June, 1912, 36; to June, 1913, 113; to June, 1914, 186; and to May, 1915, 466. The shock zone has a radius of about 3 mi. from the center of the town of Johannesburg.

H. E. Wood, chief assistant at the Union Observatory, Johannesburg, believes the shocks were due to mining operations, but does not think there is any danger to life and property on the surface by the tremors. Earthquakes, said Mr. Wood, always went over fairly large areas and involved the shifting of hundreds of millions of tons. In the case of the Rand, the amount of energy distributed could not be very large and local tremors were probably occasioned by relief of local strains only. A self-recording seismograph in use at the observatory enabled the separating, with no difficulty, of records of local tremors from those of more distant origin.

The record tended to show a rapid increase in the annual frequency of the tremors, but the numbers were affected by increased sensitiveness of the machine. The frequency and intensity of the tremors should increase from year to year, but there was no definite sign of any annual, weekly or diurnal period. The source of the disturbances was in the near vicinity of the Witwatersrand and confined to a small region at a comparatively shallow depth. If the source of disturbance were very deep, say several miles, the tremors would be felt simultaneously over a much larger area. But records of simultaneous shocks along reef towns are rare.

This led to the inevitable conclusion that the local tremors must be considered the result of mining operations. He did not think water pumping was a serious contributory cause, nor that air blasts or pressure bursts were directly connected with a local tremor. He considered the local tremors were the result of the natural tendencies of large subterranean cavities to close up under the influence of gravitation. This tendency is more marked as the horizontal dimensions of the cavities are greater than their vertical dimensions, which is the case on the Rand. The greater part of Johannesburg is built on strata below the reef, and the region will be subject to vibration effect, but not to any actual bodily displacement or subsidence. The possible danger has been recognized and methods of mining have been adopted to combat it.

Mr. Kotze, government mining engineer and chairman of the commission, said that in some instances where there had been underground subsidence, the surface of the mine had dropped 14 in., yet no shock had been recorded. On the other hand, it seemed that shocks had been simultaneously recorded with mine-working subsidences.

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*P. O. Box 3621, Johannesburg, South Africa.

E. J. Moynihan, an official of the Union Mines Department, declared that the primary cause was that the mining companies had made a tunnel in the earth some 30 mi. long and a few feet high. They had been widening this for 20 years until, on the average, it was something like a mile wide. The tunnel was also inclined in the direction of its width. Well, the roof was falling in. That was all. Then there were secondary causes. There was the contraction of the wedge overlying the tunnel due to its falling temperature, as the air circulating through the tunnel had cut off the upper wedge from direct conduction of heat from the mass of the earth below. Temperature in the upper wedge had consequently been greatly changed and much lowered in course of time. The wedge as a whole contracted and its center of gravity moved downward, which accounted for the shearing of formation above the drive pillars on the southernmost of the reefs worked. It also tended to make the strata part on the lines of strike faults, thus allowing fault blocks to slip vertically. Pumping operations tended to produce effects similar to those caused by contraction. A possibility to be borne in mind was that the thrust against the granite boss, which had tilted and faulted the Rand beds, was not a "dead" thrust, but still "living" and in operation.

Sand filling or something better would have to be adopted systematically and generally. Even so, the increase in the severity of the tremors was likely to continue for many years. He suggested filling stopes with coarse rock, then filling with stuff the size of macadam and finally flushing in as much sand as possible into the remaining interstices. The total compression in such a mass would be very much less than in the mere mass of sand flushed down with water. He believed that, with a proper amount of compression, sand filling would stop the tremors in five or ten years.

J. H. Twiddy, deputy inspector of mines, attributed the tremors to mining operations. He thought the tremors were caused by slips along faults.

A. C. Sutherland, mining surveyor in the Mines Department, thought a connection had been clearly established in some instances between the shocks and underground happenings. He believed they could be lessened by the removal of the small pillars. The pillars to be left should be very big. Sand filling would lessen the tremors, as it would pick up a certain amount of weight, but it would not do away with the shocks altogether.

Business of Henry R. Merton & Co. Supervised by British

An inquiry to the president of the Board of Trade in London, regarding the supervision that was being exercised over Henry R. Merton & Co. and other companies in which alien enemies were interested, elicited the response, according to the *Financial Times* of Oct. 29, 1915, that an inspector of Henry R. Merton & Co. had been appointed on Oct. 3, 1914, and that subsequently a supervision of the business had been appointed under the provisions of Section 12 of the Trading With the Enemy Amendment Act of 1914.

Speaking generally, the president of the Board of Trade is quoted as saying that "it was not proposed that all companies controlled by alien enemies be stopped from continuing to do business, as some of these companies serve a useful purpose. The businesses are conducted under restrictions imposed by the Trading with the Enemy acts and I doubt whether it would be expedient in the public interests to prevent their being carried on."

Metal-Mine Accidents, 1914

According to figures compiled by Albert H. Fay, mining engineer, Bureau of Mines, the number of fatalities in the metal mines of the United States during 1914 was 559, as compared with 683 in 1913. The number of men employed, however, for 1914 was 158,115 as compared with 191,276 in 1913. There is a slight reduction in the fatality rate over the previous year, the rate being 3.54 per 1,000 employed in 1914, as against 3.57 in 1913. There were 5,073 serious injuries, which resulted in a loss of time of 20 days or more, as compared with 5,890 for the preceding year. The serious-injury rate for 1914 is 32.08 per 1,000, as compared with 30.79 for 1913. There were reported 25,143 slight injuries, which resulted in a loss of time of less than 20 days, as compared with 27,081 for the previous year, or 159.02 per 1,000, as compared with 141.58 for the preceding year.

The higher injury ratios, however, for 1914 are not necessarily due to the increased hazard of mining. The enactment of workman's compensation laws and the educational campaign that has been carried on for the last three or four years by the state inspectors, mine operators and the Bureau of Mines have resulted in the mining companies keeping better records than formerly. The figures reported for 1914 are therefore more nearly in accordance with the hazard of the industry than were those for previous years. The number of companies reporting accidents in 1914 was 4,805, of which number 585 represented copper mines; 3,536, gold and miscellaneous metal mines; 196, iron mines; 248, lead and zinc mines in the Mississippi Valley; and 240, miscellaneous mineral mines.

The metal-mine-accident report for 1914 contains also a study of mine accidents by mining methods, which is a departure from the previous reports and brings out some valuable information concerning stoping, caving and room-and-pillar systems of mining as related to mine accidents. This part of the report deals with 258 mining companies representing 75,453 employees actually engaged in underground or openpit mining, exclusive of those employed at surface shops and yards. The fatality rate for the various mining methods, classified, is as follows:

Overhand stoping in narrow orebodies	4.90 per 1,000
Overhand stoping in wide orebodies	5.23 per 1,000
Room and pillar	5.76 per 1,000
Caving systems	5.10 per 1,000
Openpit with steam shovel	2.50 per 1,000
Openpit without steam shovel	2.28 per 1,000

The average fatality rate for this group of mines, based on underground and openpit employees, is 4.78 per 1,000 men employed. The serious-injury rate for the same group of mines is 51.67 per 1,000, while the slight injuries show 270.46 per 1,000.

The states of Kansas, Minnesota, New Jersey, New Mexico, Oregon, South Dakota and Virginia, and the territory of Alaska show a reduction of more than 20% in the fatality rate as compared with the preceding year. Nevada and Montana are the only states that show a continuous reduction of fatal accidents during the four years covered by the bureau's reports.

Motor Travel in Desert Country

By Lewis H. Eddy*

SYNOPSIS—Record of 500 miles of automobile travel over mining districts in southern California desert country. An average of $25 per day, or 40c. per mi., for use of automobile and service of driver, carrying two or three passengers, is the usual rate. Even this high cost is more economical than horse stage or team transportation if saving of time and the opportunity to travel at will are important. Motor vehicles are coming to be the logical successors to horse stages and freight teams in desert transportation and in the development of opportunities for railroad advancement.

The automobile is crowding the burro off the desert and rapidly reducing the number of horse-stage stations. The motor truck is gradually displacing the freight wagon and lowering the cost of haulage. The railroad is advancing into the regions explored by the automobile and broadening the trail of the prospector. During three weeks of travel by rail and automobile we saw only six burros in action—five at Randsburg ready for the trail, and one under the saddle in Panamint Valley. We saw only two horse stages—one between Ballarat and Skidoo, the other between Ogilby and the American Girl and Tumco mines. But we saw probably 50 automobiles carrying passengers or loaded with parcel post, express and mail, and motor trucks hauling ore and supplies. Deserted stage stations were numerous—concrete railway stations increasing. The automobile and motor truck are on the desert to stay, and the manufacturer that studies desert transportation will find a large field for exploitation and opportunity for improvement in design and construction.

THREE METHODS OF TRANSPORTATION IN THE WESTERN DESERT COUNTRY
First the "desert rat" with his burro; then the classic stage coach, and now the automobile

Crossing the Desert to Reach the Hills

Desert travel and the geological and topographical situation of the mines and their relation to the desert regions in southern California are not generally understood. Metal mining on the flat floor of the desert is not common practice. Some of the mines are situated in low isolated hills immediately surrounded by broad plains more or less arid, but usually they are in the foothills that form the rim of the desert, or in the higher ranges that separate the regions. The gold placers are in the gulches and low hills. Saline deposits are in the lower flat regions or in natural depressions. However, it is necessary to cross desert country to reach most of the mines in the Mojave, Death Valley and Yuma regions, and the most economical mode of travel is by automobile to points where the railroads have not been extended. If you own your automobile you may, with assured economy, start from any point south of Tehachapi and cover the entire desert regions of southern California and southwestern Arizona without going a mile by rail. If you are dependent on hired automobiles and unacquainted with the country and the roads, you had better make some use of the railroads. In either case it is not wise to travel alone. My visit to mining districts in these regions was in company with H. M. Wolflin, mining engineer, of San Francisco, whose duty was the inspection of mines under the workmen's compensation law.

We started from Los Angeles, traveling by rail via San Bernardino to Kramer, a station on the main line of the Santa Fe, where we transferred to the Randsburg branch. This runs north through the main body of Mojave Desert and has its terminus at Johannesburg, 35 mi. north of Kramer. Johannesburg is situated at the eastern edge of Kern County in a small basin between Rand Mountains on the west and Red Mountain on the east. Randsburg is a mile and a half west, situated in a similar basin in the Rand Mountains. Both towns are geographically and topographically off the desert. But the midsummer visitor imagines he is on the desert, and imagination goes a long way toward establishing belief.

Mining Camp on the Edge of the Desert

Atolia, the tungsten camp, 5 mi. southeast of Johannesburg, on the western edge of San Bernardino County, is geographically within the Mojave Desert, though the elevation is only 300 ft. lower than at Johannesburg and Randsburg. The contour line of the United States Geological Survey places Atolia at 3,250 ft., and the bench marks give the elevation of Johannesburg at 3,536 and Randsburg at 3,523 ft. above sea level. Considering the altitude, you would say this is not much of a desert. It is a desert only by distant relation and by lack of greater development of water resources. Wait till you get to Panamint Valley and on the edge of Death Valley or down Yuma way. You will then recall Atolia as merely a warm spot on the railroad and Johannesburg and Randsburg as oases. We suffered as much discom-

*Associate editor, San Francisco, Calif.

fort from the heat of the sun in the garden regions of Sacramento and San Joaquin valleys as in the Randsburg region.

Some people imagine that Skidoo is a desert mining camp and a pretty close relation to Death Valley. It is 15 miles west of the center line of the valley and about 6,000 ft. higher. You must cross either Panamint Valley or Death Valley to reach Skidoo, but after you are there you forget all about deserts.

These statements should not be construed to mean that desert travel in the regions we traversed is an enjoyable outing. On the contrary, it is a man's job to cross Mojave Desert and Panamint Valley in any month between April and October, and the wise man keeps away from Death Valley during that period unless his wisdom is of the desert. During the two weeks spent in these regions we made headquarters at Johannesburg, visiting the mines in the Randsburg, Stringer and Atolia districts afoot and by automobile, and made two visits to Searles Lake and one to the Skidoo district. After completing work here, we traveled by automobile from Randsburg to Mojave, stopping on the way at Kaehn Springs and Cisco; thence by rail to Yuma and from that point by automobile to the American Girl and Tumco mines in Imperial Valley. In Randsburg region and the Searles Lake and Skidoo districts and to Mojave, we traveled in an Overland machine driven by Ed Neihaus, of Randsburg.

Cross-Country Motor Travel not Cheap

The usual charge for automobile service in the mining districts of southern California and southwestern Arizona is $25 a day for two or three passengers. This charge varies according to roads, distances, and other conditions that may not always be foreseen. A short day and an easy road may reduce the cost, and a long hard day over bad roads may increase it. For the first trip to Trona and return to Johannesburg we paid $25. The direct distance to Trona and return is 80 mi. The trip included an early morning visit to Atolia and a 10-mile drive over Searles Lake. Including the time spent at supper at Garden station the trip occupied 14 hr. For the journey to Skidoo and return to Johannesburg, including two nights and one day at the mines, we paid $100. We occupied one day each way on the road, including a short run off the road to the Cashier mine at Harrisburg and two stops at Trona and time consumed with motor and tire troubles. The total distance traveled was 220 mi.

One hundred dollars for two days' actual use of an automobile and three days' employment of the driver seemed quite liberal and 45c. per mile a rather high transportation rate. But there were compensations. We saved two days' time and traveled when we pleased and stopped where we liked. We could have stopped two or three days longer at the mines or anywhere on the road at an additional cost of $5 per day. We could have made the trip to Skidoo by stage and return for $34 each, a saving of $16 each in money, but we would have been obliged to travel to Ballarat both going and returning and to remain there two nights. The travel would have occupied two days by automobile and two days by horse stage, without opportunity to make the desired stops.

Prior to the completion of the Trona R.R. a motor stage between Johannesburg and Ballarat and a horse stage between Ballarat and Skidoo were operated by Rinaldo & Clark, of Johannesburg, and since the completion of the railroad the auto stage runs between Johannesburg and Trona, connecting with trains, and thence between Trona and Ballarat. The horse stage still operates from Ballarat to Skidoo, but arrangements can now be made for direct service between Skidoo and Trona. Ballarat is 20 mi. northeast of Trona and several miles off the direct road through Panamint Valley to the Skidoo district. The Trona R.R. connects with the Southern Pacific (Olanche branch) at Searles station, 12 mi. north of Randsburg. There is no stage connection between Randsburg and Searles, but special auto service can be provided.

Some Visits Made Conveniently Afoot

Much of the visiting at Randsburg and vicinity, including the Yellow Aster, the Consolidated, the King Solomon, the Butte and the Phœnix mines and the Phœnix and Red Dog mills, was done afoot, where an automobile would have been practically useless. It can be done with less effort and about the same speed by saddle horse, but if your legs are good you had better use them and not bother with a horse. The cost of automobile travel in Randsburg and Stringer districts was not enough to warrant the time and worry of finding and trying out a cheaper mode of transportation. One day we covered a large amount of ground by automobile and afoot at a cost of $7.50 each. On two half-days we accomplished a surprising amount of work by automobile at a total cost of $8.50. The journey from Randsburg to Mojave, a distance of 60 mi. over the worst sand road in these entire regions, cost us a total of $25. We started at 7 a.m., stopped five or six hours at the Consolidated Salt Co.'s works and at the California Gypsum and Hollow Tile Co.'s plant, and arrived at Mojave at 3:30 p.m. We used the Overland in actual service six days, traveling 430 mi., for which we paid $172—an average of 71.5 miles a day at an average rate of 40c. per mile. Including one day's layover at Skidoo and one day spent overhauling the machine, Neihaus was employed a total of eight days, making his average earnings $21.50 per day. The higher cost in the Mojave district and the Yuma region brought the average cost for the entire trip to 42.5c. per mi. This rate should be lowered on a second trip, but there is no certainty that it would be.

Immediately upon arriving at Mojave, we engaged a Buick and driver at the outrageous rate of $4 per hr. for a short visit to the Mojave Consolidated mine, four miles distant by fair road. The travel occupied about 30 min. and we were at the mine about an hour and a half. Wolflin made another visit to the Mojave on the following day and the next day visited the Tropico mine at Rosamond, 15 mi. south of Mojave, with the same automobile at a more reasonable rate. I was due at San Bernardino on the day following our arrival at Mojave and left on the Santa Fe at 2:45 a.m., arriving in time for breakfast; Wolflin joined me three days later.

We left San Bernardino by evening train on the Southern Pacific, arriving at Yuma about midnight. We immediately engaged a Reo machine and driver at a cost of $25 to carry us the next day to the American Girl and Tumco mines in Imperial County, Calif., 20 mi. northwest of Yuma. We could have made this trip by horse stage from Ogilby, a station about seven miles southwest of the mines on the Southern Pacific, but owing to lack of hotel accommodation it would have been necessary to go

to Yuma and then return next day by rail to meet the stage at Ogilby. This meant over night at the mines, where there is no hotel. While negotiating for automobile service we were informed that the mines were 39 mi. distant from Yuma. We knew from the Geological Survey Yuma quadrangle that the American Girl mine is 9 sectional miles north and 11 sectional miles west from Yuma and that the Tumco mine is just 2 sectional miles farther north and the same distance farther west. Anyway, the automobile hire would be $25.

When ready to start in the early morning, there was delay due to the assembling of a committee of citizens in two other automobiles, who were going along to view out a new and shorter road to the mines, and we were supposed to follow them and make the travel easier for ourselves. Of course we did not follow them. They followed us. That is why we waited for them. Our driver knew the way because he and his business partner had been traveling this new road and some parts they had pioneered. The fact is, that after crossing Colorado River we followed approximately the road delineated by the Geological Survey 10 years ago, though some shorter cuts had recently been made and others were being tried out. The road mentioned as being 39 mi. long is the road to Picacho mine, 20 mi. almost due north of Yuma, from which a branch road runs west and through the cañon to the American Girl. The distance to the Tumco by this road is about 30 mi., but by the road we traveled not more than 20 mi.

I returned to Yuma in the automobile that afternoon, making the run from the American Girl in about an hour and a half, and that was lively going considering the character of the road. I ventured to express surprise at the speed we were making after I had stood about as much jolting as I thought was due, and was informed that the buoy ferry quit running at 5 o'clock, and if we did not beat it we would have to walk across the railroad bridge. Loss of one minute caused us to walk the bridge. Yuma goes by the clock. Wolflin stayed over to complete his work and went out (at a cost of $2), by horse stage, which takes 2½ hr. from Tumco, and connects with the westbound Southern Pacific passenger train about noon at Ogilby.

The mines are situated each in a broad cañon at an elevation of 700 ft., surrounded by hills that rise to a maximum elevation of 2,225 ft. above sea level. There is a gradual slope from the mines to the north bank of Colorado River, where the Survey bench mark at Rio indicates an elevation of 156 ft. Yuma elevation is 137 ft. at the station and 297 ft. one mile south. This is sure enough desert country. Nobody denies it, but nobody responsible for Yuma complains about it. In the old burro and horse-stage days the people moved slower, but they lasted longer. Looking back over a period of 20 years, I recall that the Yuma people I knew in that day were as progressive, considering the means at hand, as they are today. But the automobile is broadening the trail in this, as in other desert regions. There are many roads in this region that only an experienced automobile driver can get over in any type of machine.

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The Marketed Production of Silica in the United States in 1914, as reported by the United States Geological Survey, amounts to 181,731 tons. This includes the production of silica from vein quartz, pegmatite and quartzite, and the output of tripoli and diatomaceous earth.

The Juneau Gold Belt*

The Juneau gold belt comprises a mainland strip running from Windham Bay northwestward to Lynn Canal and Berners Bay. It contains some mines and prospects south of Juneau, those in the vicinity of Juneau, including Douglas Island, those in the Eagle River and Yankee Basin regions and those in the vicinity of Berners Bay. The geology and mineral resources of this region have been described in full by Spencer[1] and Knopf.[2]

The developments near Juneau, because of their magnitude, overshadow the operations in other parts of the gold belt, yet some of these are of importance. The active small-scale mining and milling operations that were conducted a few years ago in the Eagle River and Berners Bay districts have recently experienced a decided falling off, due in part to the failure of some of the properties to meet expectations and in part to consolidations preliminary to operations on a larger scale.

Gold lode mining in this field, already developed on a scale that ranks the Juneau district with the foremost in the industry, is rapidly assuming still greater proportions. The growth is a natural response to a fuller knowledge of the size and character of the orebodies and the economic possibilities of large-scale operations.

Climatic conditions are favorable to continuous operation. The large size of some of the orebodies, the physical character of the ores and a strong topographic relief favor the production of large quantities of ore with a minimum of labor and power. Water power, marine transportation and a local supply of timber and lumber reduce general expenses to a low point. The extraordinarily low costs of operation make available low-grade ores that under conditions only slightly different would be valueless. The milling operations in the vicinity of Juneau, in 1914, were equivalent to the constant operation of about 1,000 stamps. Mining and milling operations combined gave employment to an aggregate of about 2,250 men.

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Chino Copper Quarterly Report

The Chino Copper Co., working at Santa Rita, N. M., reports for the third quarter of 1915 a gross production of copper in the concentrates of 18,545,638 lb., divided as follows: July, 6,650,429; August, 6,640,923; September, 5,254,286. The total tonnage of ore treated for the three months was 690,400 tons, an average of 7,504 tons per day. This is the highest average tonnage treated by the mill since the beginning of operations. The average copper content of the ore treated in this quarter was 1.98%, against 2.38% for the previous quarter. The average extraction for the third quarter was 67.82%, as against 65.34% in the previous quarter.

The cost per pound of net copper produced for the quarter, after allowing for smelting deductions and crediting all miscellaneous income, was 7.18c., as against 6.10c. for the second quarter and 6.38c. for the first quarter. The increase in cost per pound is due to the fact that the average grade of the ore was lower during the third quarter, with a resulting lower recovery in pounds per

*Excerpt from Bull. 622-C, U. S. Geological Survey, entitled "Mining in the Juneau Region, Alaska," by Henry M. Eakin. 1915.

[1]"The Juneau Gold Belt, Alaska," U. S. Geological Survey, Bull. 287, 1906.

[2]"Geology of the Berners Region, Alaska," U. S. Geological Survey, Bull. 446, 1911; "The Eagle River Region, Southeastern Alaska," U. S. Geological Survey Bull. 502, 1912.

ton of ore. These costs include all operation, administration and general charges, and the regular charge of 30c. per ton of ore treated, for the extinguishment of mine development and stripping expense.

The net profit from milling operations for the quarter was $1,503,846; miscellaneous income, $51,568; a total of $1,555,414, on which dividends were paid of $652,455, leaving a net surplus over dividend requirements of $902,959.

The earnings for the quarter were based on 16.003c. per lb. of copper, as against 17.54c. in the second quarter, and 14.37c. in the first quarter. All unsold copper on hand and in transit is inventoried at 14c. per lb. During this quarter there was moved a total of 1,222,097 cu.yd. of material in place, as against a total of 1,208,360 cu.yd. for the previous quarter. Of the total amount of material removed for this quarter, 841,055 cu.yd. was stripping, the remainder being equivalent to 724,723 tons of ore.

Utah Copper Co.'s Report

The Utah Copper Co. reports for the third quarter of 1915 a production of 44,766,841 lb. of copper, divided as follows: July, 14,641,009; August, 15,966,543; September, 14,159,289. The production in the second quarter was 40,799,825 lb. During the period in question a total of 2,498,400 tons of ore was treated, which was 283,241 tons more than the previous high record of the preceding quarter. The average grade of the ore was 1.4089% copper, as compared with 1.42% for the second quarter of the year, while the average extraction was 63.59%. The low extraction was said to be due partly to the presence in the ore of considerable copper in the form of carbonate, but principally to the unusually large tonnage treated.

The average cost per pound of net copper produced during the quarter, after allowing for smelting deductions and without crediting miscellaneous income, was 7.64c., as compared with 7.49c. for the second quarter of 1915. If the net miscellaneous earnings in Utah, including those from the Bingham & Garfield Ry. were credited to the cost of operations, the net cost would be 6.76c.

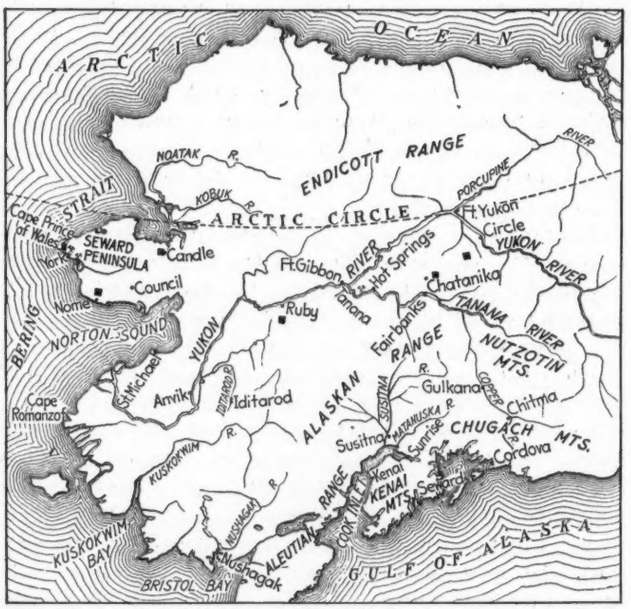
Earnings for the quarter were as follows: Net profits from milling operations, $3,663,708; other incomes, rent, etc., in Utah, $25,668; income from Nevada Consolidated Copper Co.'s dividends, $375,188; Bingham & Garfield Ry. Co.'s dividend, $350,000; total net profits, $4,414,564, from which dividends of $1,624,490 were paid, leaving $2,790,074 surplus. Earnings for the quarter are computed on the basis of 16.252c. per lb. for copper, as compared with an average price of 16.984c. for the preceding quarter. All unsold copper on hand and in transit is carried in inventory at 13½c. per lb.

The daily average of ore treated for the quarter was 27,157 tons. Of the total tonnage for the quarter the Magna plant milled about 60%, and the Arthur plant about 40%. During the period under review there was removed a total of 1,617,779 cu.yd. of capping, as compared with 1,548,132 cu.yd. removed during the second quarter of 1915. The Bingham & Garfield Ry. handled an average of 17,856 tons of ore per day from mine to mill, as compared with an average of 16,798 tons for the preceding quarter. An average of 4,269 tons of other freight was transported, as compared with 2,921 tons per day for the second quarter of 1915.

Tin Mining in Alaska*

The first discovery of stream tin in Alaska was made by the Geological Survey in 1900, on Buhner Creek in the York district, which occupies the western extremity of Seward Peninsula. In 1901-02 considerable prospecting for stream tin was carried on, the first commercial production of tin ore being made in 1902. From that time until 1911, when the first tin dredge was installed, the placers were worked on only a relatively small scale. Since 1911 the dredge on Buck Creek has operated successfully each season, and in 1914 two dredges were installed on Anikovik River, for the recovery of gold and tin together.

Lode tin was first discovered at Cape Mountain in July, 1902, and lode mining has been carried on to a greater or less extent ever since. Stream tin has also been found in different parts of Yukon Basin—on Cleary and other creeks of the Fairbanks district in 1904, in the Circle and Hot Springs districts probably in 1908, and in the Ruby district in 1912. There has been no commercial development in any of these fields except in the Hot Springs district.



* Locality where tin has been mined ■ Locality where some tin has been found

MAP SHOWING ALASKA TIN DEPOSITS

Since the discovery of tin in Alaska, a total of 526 tons of metallic tin had been produced to Jan. 1, 1915, having a value of $380,006. Practically all the tin mined in Alaska has been shipped abroad for reduction. The earlier shipments went mainly to Swansea, Wales, but lately a large part of the production has been sent to Singapore, in the Far East.

Tin Mining in the York Region

Tin ore in both lode and placer form is broadly distributed in the western part of Seward Peninsula, but commercial development has taken place at only a few localities. Lode properties have been prospected at Ear Mountain, Buck Creek, Cape Mountain, Brooks Mountain, Lost River and a few other localities of minor import-

*Abstract from Bull. 622-B, United States Geological Survey, 1915.

ance, but the only productive lode mine at present is that of Lost River. Considerable underground work has been done on the Cape Mountain property, but the mine has been closed for several years. Placer tin has been produced in commercial quantities from Buck Creek and from Anikovik and Lost Rivers. Placer operations in 1914 were confined exclusively to Buck Creek and Anikovik River.

The mining activity of the region in 1914 included the operation of three dredges for all or a part of the season, the preparation of a tract of tin-placer ground for the installation of an additional dredge, and the operation of the Lost River lode mine and mill. About 40 men were engaged directly in mining operations—20 men on Buck Creek, 5 on Lost River and 15 on Anikovik River, where two dredges operated for both tin and gold. About 25 men were also employed temporarily in the construction of the new dredge on Anikovik River. The only winter mining done in the district was at the Lost River mine, where three men were employed.

Lost River is a small stream that heads in the York Mountains and flows southward into Bering Sea, about 10 mi. east of Cape York. Freight charges from Seattle, including lighterage at Lost River, on ordinary merchandise are $12.50 per ton. The return freight rate on ore shipments is $15 per ton.

The general country rock is limestone, and there are a considerable number of vertical quartz porphyry dikes piercing the limestone. A few of the quartz porphyry dikes are highly altered and contain more or less of tin and tungsten minerals. Two dikes of this character, known as the Cassiterite and Ida Bell lodes, are being explored and developed by the Jamme Syndicate as the Lost River mine.

Tin Placers on Buck Creek and Tributaries

Placer tin occurs on Buck Creek for its entire length, about 4 mi., and on Sutter Creek and Left Fork, its principal tributaries. Gravels of Grouse Creek are tin bearing for over ¼ mi. below the mouth of Buck Creek.

Cassiterite occurs in bedrock in three ways in the Buck Creek area: As an impregnation in quartz porphyry dikes; in quartz stringers cutting the slates; and intergrown with arsenopyrite in a gangue of radial actinolite. The chief source of the stream tin is the abundant quartz stringers of the Buck Creek areas, being supplemented somewhat by the other forms of bedrock deposit.

Commercial tin placers have been developed for about 3¾ mi. along Buck Creek, and for over ¼ mi. on Grouse Creek below the mouth of Buck Creek. The development work includes drill prospecting, opencut mining and dredging. About 1½ mi. of the placer had been mined out at the close of the 1914 season. The average depth to bedrock on upper Buck Creek is only 4 ft. Downstream the depth increases slightly, and at the mouth of Sutter Creek and below it is 5 to 6 ft. The width of the placer is 60 to 200 ft.

The concentrate derived from placer operations contains cassiterite, sundry heavy iron minerals and a little gold. The average metallic-tin content of the concentrate is reported to be about 60%. The gold content is worth only a few dollars a ton, and so far it has not affected the selling price of the product.

In 1914 the American Gold Dredging Co. put two dredges into operation on the lower Anikovik. One of the dredges, formerly on Peluk Creek near Nome, was moved along the coast of Bering Sea intact, and was made to dig its own way across the bar into the mouth of the river. The other dredge was new and was installed on an artificial pond ¼ mi. from the beach. These Anikovik River placers are shallow, ranging generally between 6 and 8 ft. in depth. The chief value is in their gold content, but sufficient tin is present in them to make a valuable byproduct.

Placer Tin in Hot Springs District

Placer tin, accompanying placer gold, was discovered on Sullivan Creek in the Hot Springs district, probably in 1908. Gold mining in the district developed rapidly, but in the earlier mine development no attempt was made to save the tin ore. During clean-ups more or less of tin concentrates were thrown aside and disregarded until 1911, when 1,200 lb. was collected and shipped. The ore was found to be of high quality, and the returns from the small shipment directed attention for the first time to the possible value of tin as a byproduct.

The freight rate on tin ore from Hot Springs to Seattle is not definitely known, but it probably does not exceed $55 per ton, which is the tariff on ordinary merchandise. The shipments from Seattle to Singapore in 1914 were charged approximately $15 per ton.

The known area of occurrence of cassiterite in the Hot Springs district coincides in general with that of the productive gold placers of the Sullivan Creek Basin. The general placer zone is about half a mile in maximum width and extends for about 6 mi. from Upper Cache Creek to Woodchopper Creek.

Prospecting for Lode Tin Deposits

The local derivation of the tin ore should be emphasized, on account of the belief current in some quarters that the material of the placers has come from the vicinity of Roughtop Mountain, a belief that has led to much apparently useless prospecting for lode deposits at that locality. The so-called prospects near Roughtop Mountain were examined and samples taken, which, being tested chemically for tin, gave no trace of the metal. The prospect pits were sunk on what appears to be the ordinary country rock in a more highly altered phase near its contact with the intrusive granite. Nothing resembling the tin ore of the placers was found, nor anything that suggested the presence of cassiterite in any other form. Prospecting for tin lodes should be done in the bedrock in the vicinity of the placers, especially of the placers that contain many angular, slightly worn ore fragments. It seems certain that the bedrock source of much of the tin is to be found between Sullivan Creek and the north margin of its drainage basin, west of Quartz Creek. Whether lodes of commercial value occur in this area can be determined only by an examination of the bedrock, a difficult and expensive matter except in the mine workings or along the ridge tops, because of the thick accumulation of alluvium and rock waste.

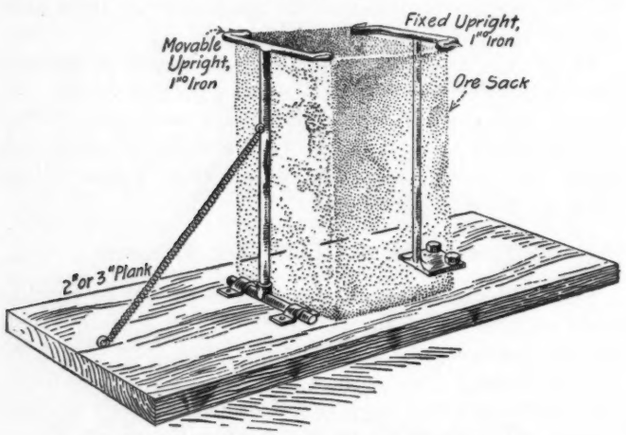
Iron-Zinc Alloys—F. Taboury (Comptes rend., 1914, 159, 241-243; abstr. "Journ. Soc. Chem. Ind.") states that crystalline deposits from galvanizing baths, separating somewhat above 422° C., were in all cases constituted of solid solutions containing 7.3% Fe. There was no evidence that these reacted with zinc at a lower temperature, even when slowly cooled, to form mixed crystals containing 0.7% Fe.

Details of Practical Mining

Simple Holder for Ore Sacks

The time required for filling ore sacks is to a large degree dependent upon the rapidity with which a filled bag can be removed and an empty one put in place for the shoveler and by the effectiveness of the device used to hold the sack open and upright while it is being filled. The accompanying sketch shows a simple device (used at the United Verde mines at Jerome, Ariz.) that fully meets all the requirements of a good holder and can be easily and quickly made by any blacksmith from materials to be found at any mine, whether operations be on a large or a small scale.

The base for the bag holder is a 2- or 3-in. plank 12 in. wide and 5 or 6 ft. long, to which, as shown in the illustration, are attached two uprights of iron, each of which has a horizontal top piece curved to resemble a horn



DEVICE FOR HOLDING ORE SACKS OPEN DURING FILLING

and sharpened at the end to grip the material of the sack. One upright is secured rigidly to the base board, while the other is attached to the base by a spring, at such distance from the fixed upright that when both are in a vertical position a bag or ore sack will hang between them when the open end is supported by the horn-shaped pieces. A coil spring, one end of which is attached to the board and the other to the movable upright, stretches the opening in the sack and holds it for easy filling.

Cheap Distillate for Oil Engines

In the Piñon Range, Eureka County, Nev., during the sinking of a 900-ft. shaft a 60-hp. Fairbanks-Morse, horizontal, one-cylinder, 4-cycle, oil engine and hoist combined was used. This was belt-connected to an Ingersoll-Rand Imperial 2-stage air compressor, 12x7½x12-in., capacity 310 cu.ft. per min.

This "oil engine" in that district was an innovation. The fuel used (variously known as "slop distillate," "No. 2 Tops" and "stove oil") was purchased of the Union Oil Co. as "stove oil," gravity of 32° Bé. guaranteed. This oil was invoiced at 3c. per gal. and the total cost laid down at the shaft was 8c. per gal.

The use of this low-grade fuel for internal-combustion engines is desirable chiefly because of the saving in cost over distillate. It is very satisfactory for use in pulling a steady load such as the compressor. When handling variable loads, as in hoisting, it does not give the satisfaction hoped for. When picking up the loaded bucket from the bottom after running "light," the engine is apt to be "killed" or miss explosions. The engineer must then leave his hoisting levers, run around to the throttles and, after adjustment, run back again. Unless he be of a specially conscientious disposition he does not run, but walks leisurely, thus losing time and boosting costs.

Speeding Up the Plane Table

By R. T. Hancock*

The use of a plane table provided with a telescopic alidade fitted with stadia points and vertical arc enables detail mapping to be done with a speed, accuracy and economy scarcely obtainable by any other means, but the weight of the alidade, concentrated as it is near one end, makes it awkward to handle, and there is difficulty in keeping the alidade edge accurately aligned on the station dot. Moving the heavy end is liable to throw the table out of orientation, and repeated trials are often necessary before the dot and the edge are near enough together to enable a ray to be drawn by inclining the pencil more or less.

The following described device overcomes all this trouble and greatly increases the speed and accuracy of the work. The alidade is placed on the board, pointing in the required direction, with its edge an inch or so from the station dot. By a single sweep of the light end—the alidade naturally revolving about its center of gravity—the distant rod is sighted and read, and a celluloid set-square, about 12 in. long and cut to an angle of about 10° or so, is laid against the alidade edge with its butt away from the observer and slid along till its outer edge is in alignment with the station dot. This is easily seen, as refraction causes the dot to jump, directly the transparent celluloid covers it. The scale is then brought up against the celluloid with its zero corresponding to the station dot, the celluloid slipped out of the way, and the distance as read by the stadia pricked off, giving the location of the rod on the map.

Assuming that, with a telescopic alidade used without this modification, the collimation line of the telescope lies exactly above the alidade edge and parallel to it—a combination rarely to be found—all the lines on the map are accurately parallel to the corresponding lines on the ground when the table is correctly oriented. If the collimation line is not thus parallel to the alidade edge, but makes an angle with it, all the lines on the map will be

*Jemoa, Northern Nigeria.

inclined at this same angle to their originals on the ground when the table is correctly oriented, but no error or distortion is introduced into the work, as the orientation was done under the same conditions of eccentricity. The use of the supplementary celluloid demands, therefore, that the table should be oriented by its means.

Resecting and Locating

In resecting from three fixed points already marked on the map, the celluloid is laid against the magnetic meridian as drawn, in the same manner as it is laid against the alidade edge, the trough compass laid against its outer edge and the table swung till the needle points to zero. The alidade is then laid pointing to each station in turn, but with its edge an inch or so from the corresponding dot, the distant station sighted by a sweep of the alidade, the celluloid brought up into alignment with the dot as described, and the back ray drawn. Some little extra care may be taken here to keep the distance between alidade edge and station dot reasonably uniform in the three cases. The triangle of error, if any, is eliminated in the usual way. If preferred—but the surveyor who has once used the "celludade" will not prefer it—the table can be oriented in the usual way by the alidade alone, and when the resection point is accurately found, the celluloid and alidade are brought up together so that the outer edge of the former touches both resection point and the most distant station dot, and the table is swung until the distant station is sighted, leaving the table in correct orientation for subsequent work with the celluloid.

In locating the position of a set-up to which a forward ray has already been drawn, the celluloid and alidade together are brought up till the outer edge of the former aligns with the ray, and the table is swung till the back station is sighted. The alidade is then laid with its edge an inch or so from another station dot, the original of which is visible from the set-up; the telescope sighted on that station by a swing of the light end of the alidade; the celluloid slid up into alignment with the station dot; and the back ray drawn, fixing the position of the set-up on the map by its intersection with the first ray and leaving the table with the required orientation.

It will be noticed that in working with the celluloid it is never necessary to move the alidade bodily while observing or to trouble to keep its edge against a particular dot—a point which surveyors who have worked with a heavy alidade will appreciate.

The error introduced by the employment of the celluloid is extremely small and amounts to an actual error in the location of a fixed point on the ground equal to the difference between the distance of the dot from the real alidade edge used for that particular fix and the distance which may be regarded as the normal distance of the dot from the edge, which latter has been referred to throughout this article as an inch or so. It is similar to, but much less in amount than, the error introduced by not centering the station dot accurately over the station, a detail which is usually regarded as a needless refinement in plane-tabling.

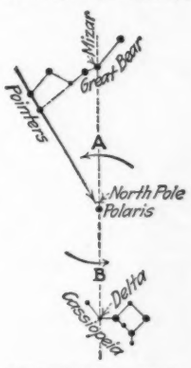
A specially cut set-square is not really necessary, but its cost is so trifling that it is well worth getting. An ordinary large 60° set-square can be used, but the consequent skew of the map as compared with the ground as it lies before the eyes of the surveyor is a little disconcerting at first.

Azimuth by Simple Method*

The usual method of obtaining azimuth from Polaris is by making observations at elongation. The following method, not new but little known, will be found much simpler in application and fairly accurate. No instrument and no nautical alamanac or mathematical tables are needed.

This method is based on the fact that Polaris and two adjacent bright stars are in the same vertical plane only a few minutes before Polaris crosses the meridian. It can be used at only one moment in each 24 hr., and a fairly clear sky is required to enable the stars to be sighted behind a plumb-line. The two stars that can be used in this observation are Mizar, the middle star in the tail, or handle, of the Great Bear, or Dipper; and Delta, in the constellation Cassiopeia. The former can be used only when it is below the pole during the night; when it passes the meridian above the pole it is too near the zenith to be of service, in which case the latter star is observed. The accompanying diagram shows the principal stars of the constellation of Cassiopeia and the Great Bear, with Delta Cassiopeia, Mizar and Polaris on the meridian. The table shows the exact time at which these stars are in the same vertical plane on given dates. The time for other days can be secured by direct interpolation, the daily variation being 4 min. of time.

OBS. ON MIZAR		OBS. ON DELTA CASSIOPEIA	
Jan. 20	5:22 a.m.	July 20	5:30 a.m.
Feb. 20	3:20 a.m.	Aug. 20	3:28 a.m.
Mar. 20	1:30 a.m.	Sept. 20	1:26 a.m.
Apr. 20	11:24 p.m.	Oct. 20	11:24 p.m.
May 20	9:26 p.m.	Nov. 20	9:22 p.m.
June 20	7:24 p.m.	Dec. 20	7:24 p.m.



MERIDIAN PASSAGE OF POLARIS

When it has been determined by observation that Polaris is in the same vertical plane with one of these stars, it can be shown that it will pass the meridian 7.8 min. later during 1915. This interval is increasing from year to year at the rate of 0.33 min., so that in 1916 the interval will be about 8.14 min. The observation can be made either indoors or out by suspending an ordinary plumb-line and marking the direction of the meridian by setting a second point at the stated interval after the two stars are in the same vertical plane.

Accident Prevention During Construction Work

During the construction of industrial plants, one of the most productive sources of accidents is improperly built scaffolding. Scaffolds are frequently built of any sort of lumber that is quickly available for the purpose, whereas only first-class material, free from knots, should be used. Generally, anything from a single board up that will meet the need of the immediate moment is considered sufficient. Serious accidents are often caused by men, particularly iron workers, taking with them heavy tools and equipment, working on a single-plank staging that had been built for the use of one man with no heavy tools. When scaffolds are raised 10 ft. or more above

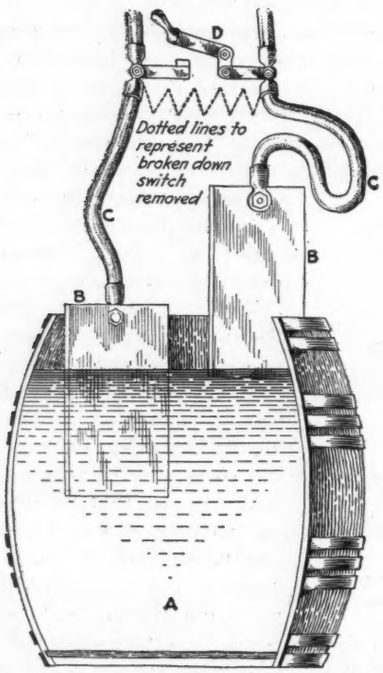
*J. A. Macdonald, Topographical Surveys Branch, Ottawa, Ont., Canada, in "Engineering News," Oct. 21, 1915.

the ground, they should be provided with toe-boards to prevent the falling of tools and material. When light swinging scaffolds, such as employed by painters, are used, all tools and materials not immediately necessary to the work in hand should be removed from the scaffold.

Working floors should be kept as clean as possible, and all permanent openings should be closed in with planking that is kept in place. These floors should always be made as tight as possible, in order to prevent tools and material from falling through onto men below. All planks on stagings or working floors should be fastened so that a man stepping on one end will not tip the plank up. Accidents from this kind of trap are almost innumerable.

Improvised Motor Starter*

Some years ago, while in charge of a small repair shop, I was called upon to repair a breakdown. The starting switch of a 100-hp. continuous-current motor driving the coal washers at a colliery had burned out. The coils had



SUBSTITUTE FOR A MOTOR SWITCH

become covered with coal dust and had short-circuited, rendering the switch useless.

The voltage was only 110, so the amperes amounted to 680 on full load. There was no spare switch sufficiently large, and another could not be obtained from the makers for some days. It was necessary to get the plant in operation as quickly as possible, and all sorts of plans were discussed, but it was thought unlikely that it could be restarted within 48 hr.

Some method of doing this work quicker had to be devised and the illustration shows what it was.

A wooden cask *A* was obtained and filled with water acidulated by the addition of a little sulphuric acid. There was no time for calculations, so we erred well on the safe side by adding more than was absolutely necessary.

Two sheet-iron plates *B* about 1 ft. 6 in. by 2 ft. $\frac{1}{16}$ in. thick were cleaned, and holes drilled in the top. By means of pieces of cable *C* and terminals, these were attached to the cables leading to and from the burned-out switch, which was removed. An ordinary knife switch *D*, large enough to take the full current, was also connected with the terminals.

When all was ready the main knife switch was put in, the switch *D* being left open, as shown. One of the plates was placed at once in the water and the other dipped in slowly, bringing it also nearer the first plate until the motor started and got up speed, when finally the plates were brought up so as to touch each other and the knife switch *D* put in. The plates were then taken out of the cask until required again.

Safe Distance for Powder Houses

How far powder houses should be kept away from railways, roads and buildings is set forth in a table drawn up by Col. B. W. Dunn, of the Bureau for the Safe Transportation of Explosives and Other Dangerous

SAFETY DISTANCES FOR EXPLOSIVES STORAGE

Quantity				Safety Distances, Feet		
Blasting Caps, Number		Other Explosives, Pounds		From Nearest Building	From Nearest Railroad	From Nearest Highway
1,000 to	5,000	....	....	30	20	15
5,000 to	10,000	....	....	60	40	30
10,000 to	20,000	....	....	120	70	50
20,000 to	25,000	0 to	50	200	120	80
25,000 to	50,000	50 to	100	240	140	100
50,000 to	100,000	100 to	200	360	220	140
100,000 to	150,000	200 to	300	520	310	200
150,000 to	200,000	300 to	400	640	380	260
200,000 to	250,000	400 to	500	720	430	290
250,000 to	300,000	500 to	600	800	480	320
300,000 to	350,000	600 to	700	860	520	340
350,000 to	400,000	700 to	800	920	550	360
400,000 to	450,000	800 to	900	980	590	380
450,000 to	500,000	900 to	1,000	1,020	610	400
500,000 to	750,000	1,000 to	1,500	1,060	640	420
750,000 to	1,000,000	1,500 to	2,000	1,200	720	480
1,000,000 to	1,500,000	2,000 to	3,000	1,300	780	520
1,500,000 to	2,000,000	3,000 to	4,000	1,420	850	570
2,000,000 to	2,500,000	4,000 to	5,000	1,500	900	600
....	....	5,000 to	6,000	1,560	940	620
....	....	6,000 to	7,000	1,610	970	640
....	....	7,000 to	8,000	1,660	1,000	660
....	....	8,000 to	9,000	1,700	1,020	680
....	....	9,000 to	10,000	1,740	1,040	700
....	....	10,000 to	20,000	1,780	1,070	710
....	....	20,000 to	30,000	2,110	1,270	840
....	....	30,000 to	40,000	2,410	1,450	960
....	....	40,000 to	50,000	2,680	1,610	1,070
....	....	50,000 to	60,000	2,920	1,750	1,170
....	....	60,000 to	70,000	3,130	1,840	1,250
....	....	70,000 to	80,000	3,310	1,990	1,330
....	....	80,000 to	90,000	3,460	2,080	1,380
....	....	90,000 to	100,000	3,580	2,150	1,430
....	....	100,000 to	200,000	3,670	2,200	1,470
....	....	200,000 to	300,000	4,190	2,510	1,680
....	....	300,000 to	400,000	4,670	2,800	1,870
....	....	400,000 to	500,000	5,110	3,070	2,040

Articles. The table is published by the Bureau of Mines in a bulletin[1] just issued.

The recommended distances vary with the quantity of explosive to be stored, up to a maximum of 2,000 to 5,100 ft. (from roads and from buildings respectively) for 200 to 250 tons of explosive.

An important auxiliary rule is given by the authors of the bulletin quoted: "No detonator shall be stored within 100 ft. of other explosives underground, or within 300 ft. of other explosives above ground. No detonator shall be taken into any magazine containing other explosives."

A Hydraulic Jack should be filled with alcohol 1 part, water 2 parts, with a tablespoonful of sperm oil added. It should never be filled with water, kerosene or wood alcohol. Water is liable to freeze or rust the jack; kerosene destroys the packing; wood alcohol destroys packing and corrodes the metal.

*John G. Grant, Surrey, England, in "American Machinist," Oct. 21, 1915.

[1]"Rules and Regulations for Metal Mines," by Ingalls, Douglas, Finlay, Channing and Hammond; Bull. 75.

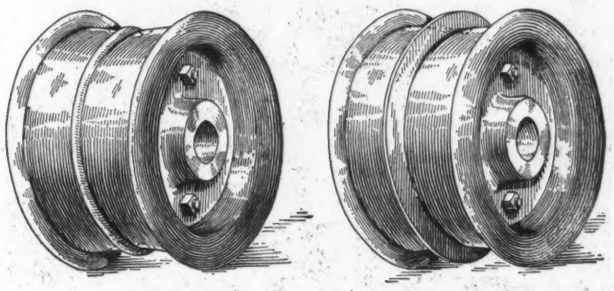
Details of Milling and Smelting

Old Car Wheels as Sheaves

By M. L. O'Neale*

Supplementary to Jesse Simmons' article in the *Journal* of Oct. 16, regarding the use of old car wheels for sheaves and carriers, I would like to give our experiences along this line.

We used these old wheels, that were worn out in the hubs, for sheaves and carriers and in some places for knuckle sheaves, where considerable weight was carried. In this latter case wear was rapid and threatened to use up our stock of discarded wheels. I therefore had our blacksmith make hoops of round iron (¾-in. in our case) with inside diameter equal to the diameter of the worn



SHEAVES FROM OLD CAR WHEELS

wheels at the bottom of the grooves, and as soon as a sheave was cut nearly through, the two wheels were unbolted and this hoop inserted. This gave three wearing points instead of one, as shown in the accompanying sketch.

To accomplish the same result in another case, a circular plate of a diameter a little greater than the wheel was inserted between the wheels, the plate being punched to take the same bolts that held the wheels together.

Turbo-Blowers as Compressors of Furnace Air

The turbo-blower is gaining in favor for blast-furnace and converter work, according to Frederick Laist, who discussed advances in copper smelting before the recent International Engineering Congress at San Francisco.

The new plant at Mt. Morgan, Australia, consists of four turbo-blowers for blast-furnace air and three for converter air, all electrically driven. Each furnace blower is capable of compressing 18,000 to 20,000 cu.ft. of free air per minute to 64 oz. per sq.in. They are each driven by a 500-volt direct-current variable-speed motor. The three converter blowers have a capacity of 5,000 cu.ft. of free air per minute and compress to 12 lb. per sq.in. They are of the latest Parsons multiple-stage centrifugal type.

A new turbo-blower for converter air, having a capacity of 35,000 cu.ft. per min., compressing to 16 lb. per sq.in., has just been installed in the smeltery power house of the Washoe Reduction Works at Anaconda, Mont. It was built by the Ingersoll-Rand Co., and is driven by a Parsons turbine rated at 2,000 hp. when running at a maximum speed of 3,500 r.p.m.

Protecting Reverberatory Walls at Douglas, Ariz.

Forest Rutherford, superintendent of the Copper Queen smelting works, in reviewing[1] the metallurgy of this plant and the changes in equipment, comments on the installation of the reverberatory furnaces because of an increase in the amount of fine sulphides. The slags made are usually high in alumina—11 to 13%—and are rather viscous.

The method of protecting the side walls of the reverberatory furnaces differs from that found at most plants. Practically no barren siliceous material is used. At first, this was the case, but it was soon found that with the very basic slags made, it was too expensive to keep the furnace properly fettled with this material, and also that in dropping it through holes in the roof, along the side walls, there was a great tendency to blanket the bath and thereby reduce the smelting capacity of the furnace.

"A series of experiments was started," writes Superintendent Rutherford, "which ended in our using, for this purpose, ores running as high as 35% Fe, as low as 25% SiO_2, with sulphur from 15 to 18% and copper about 5%. It was, of course, impossible to use this class of material throughout the full length of the furnace, because if used too close to the skimming door, some of it was carried out in an unfused state, making the slags too high in copper. We therefore lined the front half of the furnace with magnesite brick and did not attempt to clay it at all. This method, under our condition, seems to work very satisfactorily. In any case, as far as the method is concerned it is essential that the ore used must contain enough sulphur to matte all the copper, or otherwise it will stay in the slag in the form of prill and be carried out; whereas, if in the form of matte it will go through the slag into the bath below and the slag will be clean."

Electrolytic Antimony Refining

In discussing the conditions for electrolytic antimony refining, Anson G. Betts recently stated to the American Electrochemical Society (San Francisco meeting) that the fluoride electrolyte is preferable to the chloride, as no salt is carried down with the metal in fluoride electrolytes. For easy anode action the solution should contain no sulphates or other oxyacids. For instance, with sulphuric acid there is a formation of antimony sulphate, which quickly forms an insulating coating of insoluble

*Superintendent, City Mining Corporation, Coal City, Ala.

[1] "Symposium on the Metallurgy of Copper," International Engineering Congress, 1915, San Francisco, Calif.

basic sulphate. In addition, the fluorine anion has a comparatively low velocity, and other anions should be excluded as completely as possible, in order to promote the formation of antimony fluoride. A high hydrofluoric acid content is beneficial. While copper, lead, bismuth and silver are eliminated by electrolysis of impure antimony in a fluoride electrolyte, arsenic is not, nor is gold, so that further experiment is demanded. Mr. Betts suggests that in his experiments traces of H_2SO_4 and H_2SiF_6 may have vitiated the results and also suggests that the effect of alkaline fluorides (including ammonium) should be studied.

Harrison Weir-Flow Recorder

A flow recorder to be used in connection with small V-notch weirs has been designed by the engineers of the Harrison Safety Boiler Works. This device seems to have many possibilities of use in cyanide and other wet metallurgical plants, in hydraulic operations, etc.

There is a float which moves with each change of head on the weir and in turn rotates a spiral cam (laid out according to the law of the weir, $CH^{\frac{5}{2}} = Q$) through a multiplying gear. The cam moves a pen carriage which records on a paper drum the quantities corresponding to each position of the float. Backlash has been eliminated by the use of a cable drum instead of a gear and pinion, while friction has been reduced as much as possible by mounting the spindle of the cam upon antifriction rollers. The pen carriage is provided with large rollers or wheels, which rest upon horizontal ways, so that the cam follower which is attached to the pen carriage moves diametrically to the cam disk. The pen is suspended from the pen carriage so that it rests lightly against the chart drum and can readily be removed for cleaning or renewing the chart.

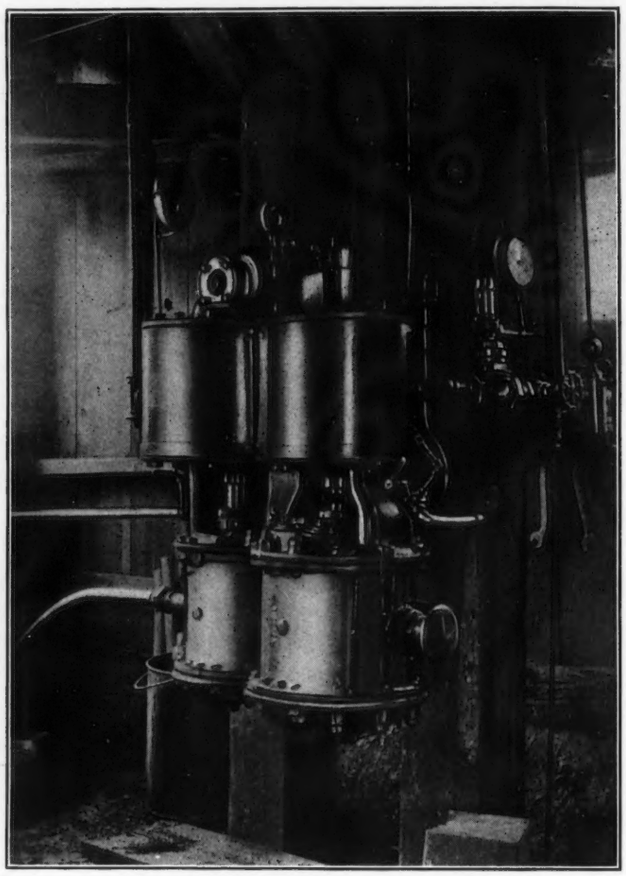
HARRISON WEIR-FLOW RECORDER

An integrating attachment consists of a counting train, likewise suspended from the pen carriage and driven by a small roller which rests upon an aluminum clock-driven disk. When the float and cam are at the position corresponding to the zero head, this roller is at the center of the disk, and hence receives no motion from the rotation of the latter. As the pen carriage is moved away from the zero position, the small roller is carried away the same distance from the center of the aluminum disk, and hence is propelled at a rate corresponding to the rate of flow over the weir. The total movement of the counting train will therefore correspond to the total flow. Further, a visible pointer moving along a large scale with open divisions has been added, making it possible to read the rate of flow from a distance.

All parts of the mechanism of this recorder are made to accurate dimensions by means of templates and limit gages. To be sure of the accuracy of the instrument it is only necessary to know that it is properly adjusted—that is, when the float is at zero position; in other words, when the level of water upon which it rests is at the zero level of the weir, the cam must be at zero position, the pen on the zero line of the chart and the integrator roller at the center of the aluminum disk.

Air Compressor for Prospecting

In prospecting work, when economy is the watchword, it is often possible to make profitable use of a locomotive-type air compressor. This is done at the Columbia mine, Keystone, S. D., where the installation shown in the photograph has been put up. It has a capacity of 151 cu.ft. of free air per minute, and is used for operating jackhamer drills. The machine weighs 1,850 lb. (2,125 when crated for shipment) and is erected on two 10x10-in. posts set 4 or 5 ft. into the ground.



A LOCOMOTIVE-TYPE AIR COMPRESSOR

Roasting Wisconsin Sulphides for Magnetic Separation

The improved Campbell kiln, now operating in the plant of the Linden Zinc Co., Linden, Wis., is making a record in magnetizing the coarse Wisconsin ores for magnetic separation. Recent tests show 10 tons roasted in 3 hr. and 50 min. Other tests show 1⅝ tons per hr. average run, using only one fuel-oil fire. An average of 8 lb. of flue and smoke-box dust is recovered per ton of ore treated.

The Cost of Doing Things

Cost of Sinking 900-Ft. Shaft

By H. A. Linke*

During the year 1913 an exploratory shaft was sunk 900 ft. in the Piñon Range, Eureka County, Nevada. The general arrangement of the surface equipment is shown in Fig. 1. It consisted of a 60-hp. Fairbanks-Morse horizontal one-cylinder 4-cycle oil engine and hoist combined, belted to an Ingersoll-Rand Imperial-type 2-stage air compressor, 12x7½ in.; capacity 310 cu.ft. per min. The receiver was 42 in. by 8 ft.

The substantial timber headframe had backstays 10x10 and front posts 8x8. The height from collar of shaft to center of head sheave was 50 ft. The hoisting rope was ¾-in. Hercules, "Red Strand." A sinking bucket of ½-ton capacity was used and drilling was done with two Ingersoll-Rand jackhamers.

Two 8-hr. shifts were run, the day shift consisting of 2 miners at $4, 1 topman at $3, 1 engineer at $4.50, 1 timberman at $4 and 1 teamster at $3; and, in the night shift were 2 miners, 1 topman and 1 engineer; making a daily complement of 10 men.

The size of the shaft inside timbers was 3 ft. 6 in. by 7 ft. 8 in., divided into 3 ft. 6 in. by 3 ft. 6 in. hoisting compartment and 3 ft. 6 in. by 3 ft. 8 in. manway and pipe compartment. The shaft was timbered with 6x6 ring sets, 6x6 divider and 6x6 posts; the sets were 6-ft. centers in upper portion of shaft, but lengthened out as ground became firmer with depth; the guides were 4x4. Lumber procured from northern Washington was excellent red fir costing $32 per M laid down.

The cost of sinking this shaft, the excavation for which measured approximately 5x9 ft., is given on page 847.

*Newhouse Hotel, Salt Lake City, Utah.

It will be noted that the work is divided into two separate sections; that is, from surface to 575 ft. and from 575 ft. to 900 ft. When the shaft had reached a depth of 575 ft. the engine house was lost by fire. When sinking was resumed after reconstruction, the footage cost was considerably higher than that immediately preceding the fire, owing to breaking in a new crew of men and the delays incidental to readjustments and repairs to machinery.

The costs given cover only labor, material and supplies used; no overhead charges are included.

The engine cost, laid down at the site, including 5 cooling-water tanks, 1 water-circulating pump, 50 ft. 8-ply rubber belt, tank pump, tools and incidentals was $4,371.05; material in foundation, laid down, $318.52; labor—foundation and installation of engine—$567.18; making the total cost of the hoisting engine complete in place, $5,256.

The engine house was originally a box-type battened building with matched floor and roof covered with roofing paper. This building was easily heated in winter. After the destruction of this building the new shelter was of much cheaper construction—boxed and roofed with red corrugated iron and the floor filled in with fine stuff from the dump. Although the metal-covered house was nearly fireproof, it was very difficult to keep warm in winter and the general unsightliness of a dirt floor did not tend to promote tidiness on the part of the engineers.

The jackhamers used in sinking the shaft were also an innovation in the district. They gave excellent service at a minimum cost for upkeep and repairs. Drilling was performed with two machines, but three were in commission, one being kept clean and in readiness for use as a spare.

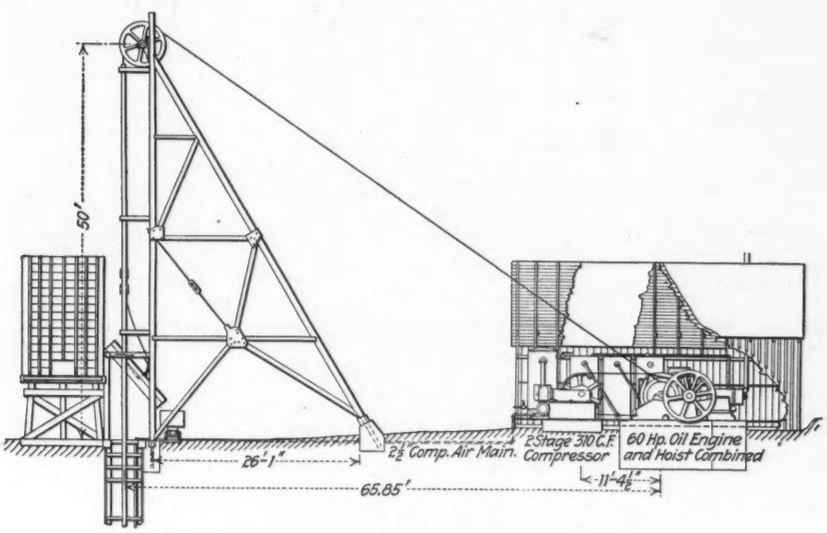


FIG. 1. HEADFRAME AND SURFACE PLANT FOR SMALL EXPLORATORY SHAFT

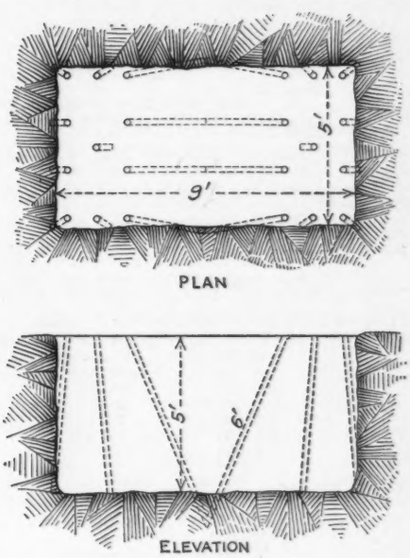


FIG. 2. LAYOUT OF HOLES FOR SHAFT ROUND

The shaft round consisted of from 18 to 22 holes. An average round was drilled approximately as per sketch (Fig. 2).

Electric exploders were tried at first, but those purchased were so unsatisfactory that their use was discontinued and the old-time reliable fire fuse was then used with satisfactory results. The ground was dry and broke very poorly. Being much shattered and faulted, it broke "short" and often to horizontal slips part way the depth

COSTS OF SECTION ONE OF SHAFT

Sinking Costs

Labor	Dec. 1912 to Mar., 1913, 0-193 Ft.	Apr. 1913, 193-296 Ft.	May, 1913, 296-406 Ft.	June, 1913, 406-490 Ft.	(16 Days) July, 1913, 490-575 Ft.	Totals
Drilling	$691.08	$305.58	$313.66	$252.27	$199.43	
Mucking	814.99	371.02	347.68	302.90	205.79	
Steel sharpening	43.05	6.76	22.50	16.50	12.00	
Gen. repairs	318.73	21.64	32.69	10.25		
	$1,867.85	$705.00	$716.53	$581.92	$417.22	$4,288.52
Material						
Drilling	$368.04	$260.17	$298.58	$184.67	$145.61	
Mucking	156.00	120.53	99.81	87.46	63.07	
Steel sharpening	3.94	2.98	2.12	.95	1.21	
General expense	100.36	53.56	57.20	43.68	43.70	
	$628.34	$437.24	$457.71	$316.76	$253.59	$2,093.64
Totals	$2,496.19	$1,142.24	$1,174.24	$898.68	$670.81	$6,382.16

From the foregoing are computed the following:

100-Ft. Intervals	Cost per 100 Ft.	Av. Cost per Ft.
0–100	$1,293.00	$12.93
100–200	1,280.82	12.81
200–300	1,107.31	11.07
300–400	1,067.52	10.67
400–500	1,041.60	10.42
500–575	591.91	7.89
Depth sunk.. 575 ft.	$6,382.16	$11.10

Timbering Costs

Labor	Dec. 12 to Mar., 1913, 0-148 Ft.	Apr., 1913 148-244 Ft.	May, 1913, 244-368 Ft.	June, 1913, 368-478 Ft.	(1 to 16) July, 1913, 478-525 Ft.	Totals
	$635.41	$226.53	$253.28	$310.10	$125.77	$1,551.09
Material						
Timber, etc.	$515.39	$303.73	$279.30	$326.31	$140.63	
Apportionment of gen. expense	15.39	9.98	12.90	11.44	4.89	
	$530.78	$313.71	$292.20	$337.75	$145.52	$1,619.96
Totals	$1,166.19	$540.24	$545.48	$647.85	$271.29	$3,171.05

From the foregoing are computed the following:

100-Ft. Intervals	Cost per 100 Ft.	Av. Cost per Ft.
0–100	$787.90	$7.88
100–200	670.92	6.71
200–300	493.95	4.94
300–400	487.60	4.88
400–500	586.38	5.86
500–525	144.30	5.77
Depth timbered... 525 ft.	$3,171.05	$5.99

Total Cost of Sinking and Timbering

100-Ft. Intervals	Cost for 100 Ft.	Av. Cost per Ft.	
0–100	$2,080.90	$20.81	
100–200	1,951.74	19.52	Av. cost of completed shaft per ft., $17.44.
200–300	1,601.26	16.01	
300–400	1,555.12	15.55	
400–500	1,627.98	16.28	
500–525	341.60	13.66	
525–575	394.61	.....	Not timbered
Total depth.. 575 ft. Timbered to 525 ft.	$9,553.21	= Total cost shaft to date.	

Station Cutting

Labor	Mar. 1913, 1st Sta.	Apr., 1913, 2nd Sta.	May, 1913, 3rd Sta.	4th Sta.	June, 1913, 5th Sta.	Total
Drilling	$50.05	$55.95	$54.58	$27.75	$58.23	
Mucking	68.64	41.10	63.88	56.67	58.29	
	$118.69	$97.05	$118.46	$84.42	$116.52	$535.14
Material						
Drilling	$46.58	$37.51	$51.28	$22.57	$45.06	
Mucking	23.40	14.49	11.60	10.62	14.34	
	$69.98	$52.00	$62.88	$33.19	$59.40	$277.45
Timbering						
Labor	$57.30					
Material	36.17					
	$93.47					$93.47
Totals	$282.14	$149.05	$181.34	$117.61	$175.92	$906.06

Average cost per station, $181.21.

COSTS OF SECTION TWO OF SHAFT

Sinking Costs

Labor	Oct. 14-31, 1913, 575-605 Ft.	Nov. 1913, 605-675 Ft.	Dec. 1913, 675-760 Ft.	Jan., 1914, 760-845 Ft.	Feb. 1-21, 1914 845-900 Ft.	Totals
Drilling	$151.25	$281.88	$339.23	$205.00	$155.69	
Mucking	133.49	366.63	312.67	293.26	159.54	
Steel sharpening	20.65	32.50	25.68	17.75	42.35	
General repairs	12.38	23.19	28.47	71.13	27.35	
Wood for fires	.....	.....	18.00	.....	.....	
	$317.77	$704.20	$724.05	$587.14	$384.93	$2,718.09
Material						
Drilling	$137.63	$233.88	$277.12	$195.66	$170.40	
Mucking	32.80	87.05	87.20	58.32	43.28	
Steel sharpening	2.00	4.35	2.62	1.18	4.39	
General expense	49.50	115.50	140.25	140.25	90.75	
	$221.93	$440.78	$507.19	$395.41	$308.82	$1,874.13
Totals	$539.70	$1,144.98	$1,231.24	$982.55	$693.75	$4,592.22

From the foregoing are computed the following:

Intervals	Total Cost	Cost per Ft.
575–600	$449.75	$17.99
600–700	1,596.93	15.97
700–800	1,331.64	13.32
800–900	1,213.90	12.14
Depth sunk.. 325 ft.	$4,592.22	$14.13

Timbering Costs

Labor	Oct. 14-31, 1913 525-566 Ft.	Nov. 1913, 566-646 Ft.	Dec., 1913, 646-725 Ft.	Jan., 1914, 725-830 Ft.	Feb. 1-21, 1914, 830-875 Ft.	Totals
	$124.25	$225.07	$275.88	$142.41	$165.78	$933.39
Material						
Timber, etc.	$30.12	$142.73	$147.92	$185.77	$29.43	
General expense	$13.98	27.28	26.95	35.82	15.35	
	$44.10	$170.01	$174.87	$221.59	$44.78	$655.35
Totals	$168.35	$395.08	$450.75	$364.00	$210.56	$1,588.74

From the foregoing are computed the following:

Intervals	Total Cost	Cost per Ft.
525–575	$212.79	$4.48
575–600	123.45	.....
600–700	534.99	5.35
700–800	403.20	4.03
800–875	314.31	4.19
Depth timbered... 350 ft.	$1,588.74	$4.54

Total Cost of Sinking and Timbering

Intervals	Total Cost	Cost per Ft.	
525–575	$212.79	$4.48	(timbered only)
575–600	573.20	22.93	Av. cost of completed shaft per ft., $18.88.
600–700	2,131.92	21.32	
700–800	1,734.84	17.35	
800–875	1,224.73	16.33	
875–900	303.48	12.14	(not timbered)
	$6,180.96		

Note: Total cost of sinking and timbering from surface to 875 feet is $15,430.69; giving average cost per ft. of $17.75. Total cost of 8 stations is $1,395.51; giving average cost per station of $174.44.

Station Cutting

Labor	Nov. 1913, 6th Sta.	Dec., 1913, 7th Sta.	Jan. 1914, 8th Sta.	Totals
Drilling	$38.59	$36.19	$56.69	
Mucking	56.63	45.46	41.82	
	$95.22	$81.65	$98.51	$275.38
Material				
Drilling	$35.43	$40.75	$32.50	
Mucking	19.20	16.43	11.07	
Apportionment of gen. expense	20.23	20.23	20.23	
	$74.86	$77.41	$63.80	$216.07
Totals	$170.08	$159.06	$162.31	$491.45

Average cost per station, $163.82.

Cross-Cutting on 100-Ft. Level

Labor	Sept. 20-30, 1913, 0-26 Ft.	Oct. 1-14, 1913, 26-74 Ft.	Totals
Drilling	$71.50	$194.25	
Mucking	48.51	127.78	
Repairs, etc	10.13	.....	
Steel sharpening	.....	23.09	
Gen. labor	26.00	48.00	
	$155.14	$393.12	$548.26
Material			
Drilling	$48.23	$154.60	
Mucking	19.10	38.78	
Steel sharpening	.....	2.00	
	$67.33	$195.38	$262.71
Totals	$222.47	$588.50	$810.97

74 feet of drifting, giving average cost per ft. of $10.95.

of the round. The endeavor was to pull a 5-ft. round; the cut holes drilled 6 ft. and the balance of round 5 ft.

Powder of various strengths was used—60%, 40% and 35%. The best all-round results were obtained by loading with 35% throughout. There was 8.4 lb. of powder used per foot of shaft, which is equivalent to 1.45 lb. of powder per ton of rock removed; there being approximately 5.8 tons rock per foot of shaft.

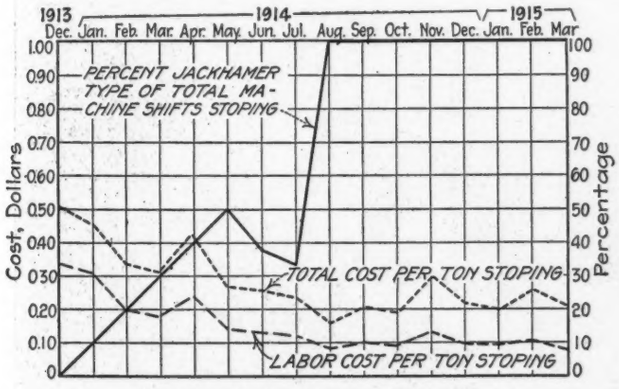
Sinking progressed from Dec. 1, 1912, to July 17, 1913, and from Oct. 18, 1913, to Feb. 21, 1914, or 354 days, at the rate of 76¼ ft. per 30-day month. This includes all delays due to repairs and temporary shutdowns due to labor shortage. The first 60 ft. was handwork, using the windlass for hoisting.

The use of candles for illumination when drilling the shaft round was out of the question. The dust raised in drilling and cleaning holes was very thick, and the exhaust from two machines extinguished candles as soon as relighted.

Two Wolf No. 1 carbide lamps were used and gave general satisfaction. As they furnished a very brilliant light, they could be hung high up in links of the chain ladder, beyond reach of the drill exhaust.

Stoping Costs at Iron Mines, Mineville, N. Y.

At one of the large iron mines, Mineville, N. Y., charges to stoping cover the expense of breaking the ore after it has been developed by drifts and raises. The principal labor items so charged are for machine runners and helpers, blasters, roofmen, drill sharpeners and drill-



STOPING COSTS AT MINEVILLE

machine repairs. The principal supply charges are for explosives and compressed air. Therefore the cost per ton for stoping, more particularly the labor cost, is a direct measure of the efficiency of the drilling. There are, however, some fluctuations in the cost curve due to varying tonnage hoisted each month, it being impossible to get the number of tons broken each month from which to derive stoping costs per ton.

The accompanying curves cover a number of months during the period from when we started to use Jackhamer-type machines for stoping up to the present. They give for each month the labor cost per ton for stoping, the total cost per ton for stoping and the percentage of total machine drifts charged to stoping which were Jackhamer-type machines. They show that while the percentage of the Jackhamer type rose from zero to 100% the total stoping cost per ton fell from 51c. to 20c. and the labor cost per ton stoping fell from 34c. to 8c.

Milling Costs in Alaska

The following figures on milling costs were taken from the annual reports of the Alaska Treadwell Gold Mining Co., Alaska United Gold Mining Co. and the Alaska Mexican Gold Mining Co., Douglas Island, Alaska, for year 1914:

	COST PER TON MILLED				
	Alaska Treadwell 240-Stamp Mill	300-Stamp Mill	Alaska Ready Bullion Mill	United 700-Ft. Claim Mill	Alaska Mexican Mill
Crushing	$0.038	$0.037	$0.016	$0.031	$0.022
Tramming	.016	.016	.016	.015	.016
Stamping	.172	.138	.165	.166	.159
Concentrating	.054	.050	.067	.052	.048
Total	$0.280	$0.241	$0.264	$0.264	$0.245

These costs consisted of:

Labor	$0.110	$0.079	$0.112	$0.099	$0.098
Supplies	.053	.063	.046	.062	.043
Subsidiary accts.	.117	.099	.106	.103	.104
Tons ore crushed.	382,652	527,633	233,100	225,214	233,457

There were 33,774 tons of concentrates produced from the ore treated by these mills. This product was treated by cyaniding at a cost of $2.756 for operating, not including general expenses, train service, etc. This cost per ton consists of the following charges only: Grinding, 49.6c.; dissolving, 97.7c.; filtering, 32.6c.; precipitation, 42.6c.; and refining, 53.1c. These charges were made up of $1.271 for labor, 93.1c. for direct supplies and 55.4c. for subsidiary accounts.

Cost of an Electric Iron-Smelting Plant

The electric iron-smelting furnaces at Hagfors, Sweden, are 4.7 m. across the widest portion of the crucible, 14.7 m. from ground to feed floor and 11.4 m. from the bottom of the crucible to the feed floor. Each furnace is fed by three 1,000-kw. transformers. The cost of this installation of three furnaces is given by *Le Genie Civil*, Aug. 28, 1915, as follows:

Foundations	$59,000
Furnaces	61,500
Transformers and accessories	71,000
Crushing apparatus	9,500
Ore and fuel bins	28,000
Pumps and piping	3,350
Grading and industrial railways	9,650
Accessories	1,360
Cost of research and experiment	9,200
Total	$252,560

Cost of Road Building

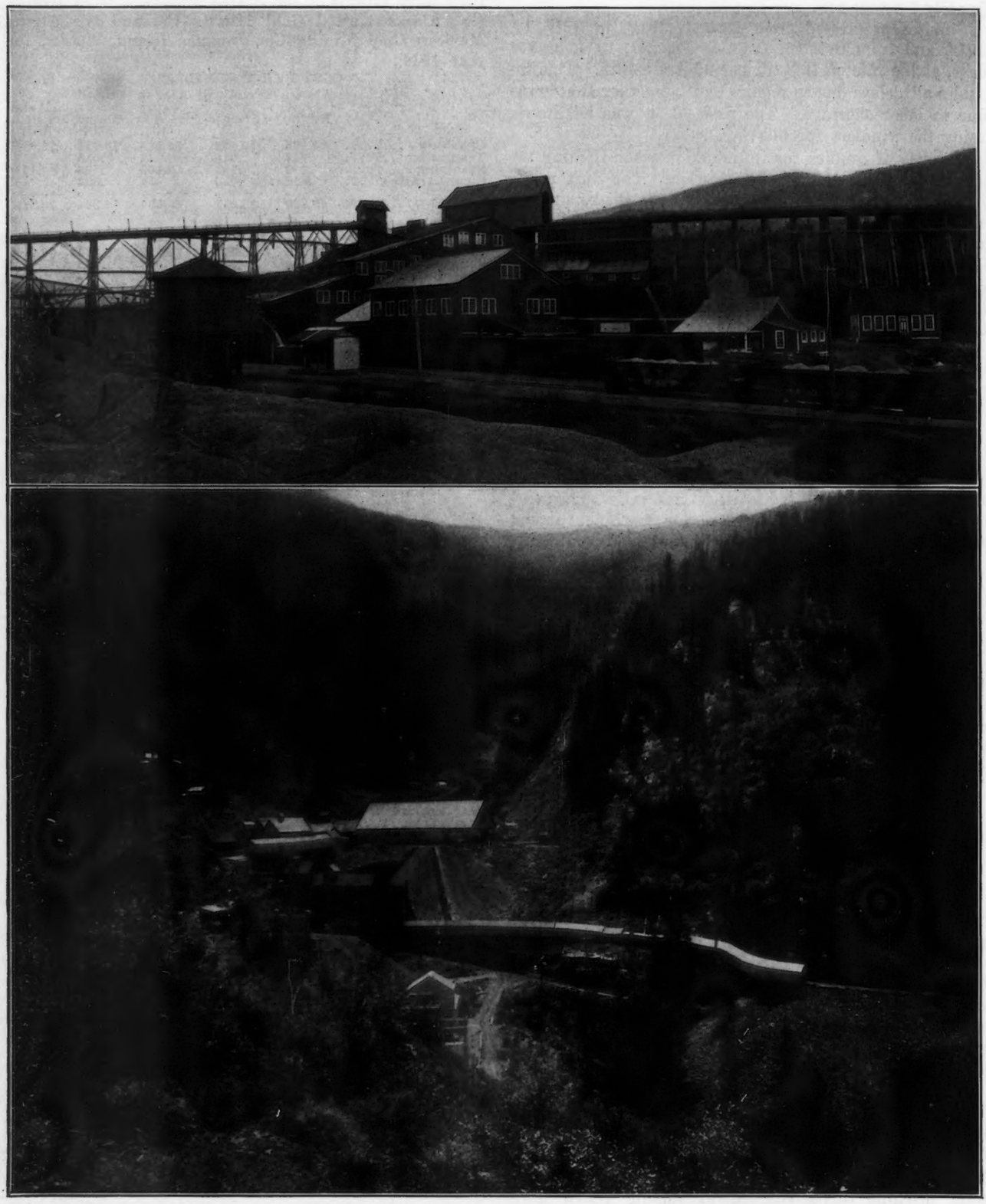
While carrying on an extensive campaign of churn drilling at Sacramento Hill, Bisbee, Ariz., by the Copper Queen, it was found necessary to do much road building to facilitate moving the drills from hole to hole. Drilling was continued for a period of 22 months.

The cost[1] of the road building for the period was as follows: Labor and supplies, $22,065.77; footage of road, $15,092; cost per foot, $1.02.

The Cost of Unloading Brick at a Salt Lake Valley smeltery was as follows: With labor at $1.75 per 9-hr. day the average cost of unloading brick from gondola and box cars, inclusive of wheeling an average distance of 100 ft. and stacking, was $0.50 per 1000 brick, labor cost only.

[1]From "Churn-Drilling Costs, Sacramento Hill," presented at San Francisco meeting, A. I. M. E., September, 1915.

Mills of the Coeur d'Alene



THE SWEENEY MILL, AT SWEENEY, FORMERLY THE LAST CHANCE, AND THE TAMARACK & CUSTER MILL

THE SUCCESS MINE AND MILL AND THE MARSH MILL, BOTH IN NINEMILE CAÑON. BOTH ARE OPERATING PROFITABLY UNDER PRESENT MARKET CONDITIONS

Correspondence and Discussion

Anaconda's Campaign for Safety First

The editorial on "Anaconda's Campaign for Safety First" in the *Journal* of Oct. 30, 1915, contains some criticisms of matters of "pure statistical practice," which charge us, at least by inference, with certain errors of which we are not guilty.

In taking these matters up in detail, I wish first to call attention to the *Journal's* objection to our practice of determining the accident rate by dividing the number of accidents by 10,000 shifts. The objection is supported by the statement that both the divisor and classification are odd, and that the results obtained cannot, therefore, be compared with figures given by other companies. You also contend that the correct basis is, of course, the number of accidents per 300,000 man-days, basing your contention upon the fact that the United States Bureau of Mines is trying to introduce this system. Subsequently, you discuss "What is a serious accident?" and say that in the statistics we have given we have left you quite in the dark by lumping fatal and serious accidents.

In reply I may say that the data published in the *Anode* are published primarily for the information of the Anaconda Copper Mining Co.'s employees for the purpose of enlisting their interest in our safety-first campaign. It is therefore necessary to present the data that we publish in such form as will be most readily understood by them. Everybody in Butte knows what a "shift" means, and has therefore some comprehension of what is implied by the number of accidents per 10,000 shifts. Should we publish information concerning the number of accidents per 300,000 man-days, I believe there would be many who would not so readily understand what was meant.

In view of the fact that there is no universally accepted standard method of reporting accident data, I do not see how we can report ours so that they will be universally comparable.

In regard to the discussion "What is a serious accident?" there will be found at the head of each monthly tabulation published in the *Anode,* a statement that the accidents considered are those that caused at least a certain number of days' lost time. During the months of January, February and March we classified as serious all accidents that caused the loss of more than 12 days' time, and on Mar. 1 we raised this limit to 14 days' lost time. No correction was necessary to make the accident rates for the months of January, February and March comparable with those of the succeeding months. There is also at the bottom of each tabulation a note giving the number of fatal accidents included in the tabulation and the names of the mines at which they occurred.

In the September number of the *Anode* we published a tabulation showing the accident rates for the first six months of the present year and the decrease in these rates. In this tabulation no separation was made between fatal and serious accidents. Possibly this should have been done, but as I have mentioned, this information was published solely as a news item of interest to employees.

In another paragraph the *Journal* takes our figures giving the number of accidents per 10,000 shifts and by a mathematical process deduces the number of accidents per thousand men employed per year, assuming that each man works 25 days per month and 12 months per year. Then you say, "However, this figure is not comparable with anything else that we know of." May I call attention to the fact that the figure complained of is the result of your own deductions and that we have not used it? As a matter of fact, it is identical with the accident rate per 300,000 man-days, the use of which the Bureau of Mines is advocating, and which the *Journal* previously assured us was the correct basis that all should use.

In conclusion, I may say that the Bureau of Safety of the Anaconda Copper Mining Co. is most anxious to cooperate with all those engaged in this work of preventing industrial accidents. Any information it may have will be freely given to those desiring it, and if the publication of statistical data in any particular or standard forms will assist the work, it will be only too glad to use those forms.

A. S. RICHARDSON.

Butte, Mont., Nov. 5, 1915.

Technical Journalism and Mining Brokers

I have read Arthur Prill's article in the *Journal* of Oct. 16, anent the desirability of mining engineers, as a profession, making serious efforts to better the standard of the mining industry, particularly in relation to promotions. As to the merits of the remedy suggested—a sort of Dun and Bradstreet applied to mining reports, etc.—although most laudable, I am afraid it is lacking the most direct principles for coping with the situation.

In this, as with any other phase of commercial or professional morality, we are confronted with a condition that Tolstoy recognized when he postulated that the evolution of society is based on the evolution of the individual units constituting society. And although it may seem a hard assertion to make, yet the fact remains that the standard of morality existing in regard to mining promotions is a direct reflex product of the standard of morality existing among mining engineers themselves. The one is a corollary of the other. For that matter, in this particular we are confronted with a fundamental of the psychology of morals; for example, that the principles of an aggregate are but the sum of the individual contributions.

Some months ago I received a circular letter inviting me to attend a meeting for the purpose of forming a local chapter of the American Mining Congress. At that particular time there was an effort being made by sundry people, who probably designate themselves as "mining men," to "boom" a particular mining district not a thousand miles from Salt Lake City, the "messiah" of the

movement being a gentleman who has known what it is to be a guest of the authorities at a certain institution of detention. In reply to this invitation I wrote, asking for particulars as to specific directions in which it would be aimed to advance the mining industry and, *inter alia*, what would be the attitude of the organization in the case of some plan being incubated for fleecing the public; whether it would be the taking of a "club" and beating the gentry involved into insensibility, or the attitude of unctuously prostituting the "am I my brother's keeper" query, and sitting back waiting to join in that old, old refrain, "Dilly, dilly, come and be killed," as the old lady plaintively sang to the duck that was marked for the next day's dinner. My letter remained unanswered.

It doesn't take much moral "guts" to speak the truth when the truth fits the situation better than lying, and there is scant credit in being honest and in meeting one's just obligations when the bank account is in a healthy condition. But to tell the truth when it hurts, and to "play the game" when it means practically almost financial suicide, is quite another matter. It is comparatively an easy matter to grow orchids in a hothouse, and there is no great tax on moral effort to restrain from evil under the hypnotic influence of music in a revival meeting. As a matter of fact, however, there is no greater asset that a professional man can have than the justly earned reputation of being straight. True ability is not such a very scarce commodity in these days of intensive technical application, but we have only to follow some lawsuit to be driven to forceful conclusions as to the other phase of the question, for expert services are by no means always "retained"—"bought" would be a more fitting expression.

Some years ago a certain doctor found the plodding life of practicing in a small country town rather hard hoeing. His first choice was for the honorable life, but the financial results were hurting. And so he conceived of a plan to make some easy money, which consisted in floating a company to advertise the curative properties of applying various so-called secretions of certain animal functions to corresponding physical ailments. In about a couple of years this man became wealthy and then withdrew from his publicity campaign and once more entered the professional fold, specializing as a high-class practitioner in a fashionable part of New York. He placated his conscience by the "auto-suggestion" that he diverted from professional morality only once. The burglar or murderer could utilize the same mental palliative with equal justice.

As to the profession of mining engineering, there is a remedy, and although I dislike the rôle of being dogmatic, I believe such remedy leaves no alternative: The formation of a society wherein every member shall place his professional record and moral entrails before a council before admission thereto, and then subscribe to a severe standard of ethics, any deviation from which—which action would be open to the formation of definite charges by brother members—to be erasure from the rolls. And in addition to general ethics, for the members of this society to be governed by a standardization of technique as to reports or the utilization of the name in relation thereto, etc. A society which, by the rigidity of the moral qualifications and deportment imposed would mean something—both to the member utilizing its insignia and to the public. Not necessarily that the fact that a man is such a member would by any means imply guarantee of any technical opinion expressed, for there is too much to learn to hope for any such degree of definiteness; but at any rate we could insure absolute professional honesty.

When, as a profession, we have purified ourselves, we can with good grace take the proper steps to prevent the shyster promoter from prostituting our profession.

Any society, to be worthy of its object, should make its standard of requirements one which a member could utilize with assurance in proffering them to a surety company if applying to such company for indemnity bonds. Such societies would require applicants to place their whole life's record upon the table.

The remedy is simple enough. There is only one question involved: Do we want to "take the medicine?"

Salt Lake City, Oct. 24, 1915. JOSEPH RALPH.

Society Employment Bureau

It is possible the Western Society of Engineers, 1745 Monadnock Block, Chicago, Ill., may attempt seriously the establishment of an employment bureau for the benefit of technical men and employers of technical men.

Active coöperation is desired. We wish to receive from officers and past officers of societies that have made similar attempts the reasons for failure, if failure was met, and what degree of success was encountered. We should like to hear from every man that has any ideas on the subject and we shall not be appalled if the mails are filled with letters of advice or information. We know the task, if properly attempted, is a big one, hence the desire to receive the benefit of experience and information that is certainly available.

The bureau will be run—if it is started—as an adjunct to the society, and there will be no fees to pay. It will be free in every way and designed to take the men out of the hands of employment agencies, which bleed unfortunate technical men that have no other means for securing positions. ERNEST MCCULLOUGH,

First Vice-President, Western Society of Engineers.

Chicago, Ill., Oct. 27, 1915.

Fettling Reverberatories

Referring to the correspondence printed in the *Journal* of Jan. 23 and Oct. 16, 1915, with regard to the first roof-fettling of large reverberatory furnaces, I find that the Charles who was at Cananea is not the Charles who took out the patent, but is a cousin of his and is a brick mason. The name, Harry Charles, was given me under a misapprehension, my informant thinking that I wished to know the name of the patentee, and not of his cousin, who worked for us at Cananea. L. D. RICKETTS.

Warren, Ariz., Oct. 29, 1915.

Fineness of Ore Crushing for Assaying

Remembering that "it is a condition and not a theory that confronts us," I would be very glad to have E. J. Hall give the practical data to show that the decomposition $2NaHCO_3=Na_2CO_3+H_2CO_3$ "is to all intents and purposes complete before any fusion takes place"[1] in an ore-assay fusion. FREDERIC P. DEWEY.

Washington, D. C., Oct. 25, 1915.

[1] "Eng. and Min. Journ.," Oct. 16, p. 649.

NEW PUBLICATIONS

THE PHOSPHATE DEPOSITS OF FLORIDA. By George Charlton Matson. Pp. 101, illus. Bull. 604, U. S. Geological Survey, Washington.

THE JOURNAL OF THE IRON AND STEEL INSTITUTE. Vol. XCI, No. I, 1915. 5¼x8¼, pp. 711, illus. Iron and Steel Institute, 28, Victoria St., London, S. W.

TRANSACTIONS OF THE AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. 6x9, pp. 308, illus. Vol. VII, 1914; $6. D. Van Nostrand Co., New York.

WABANA IRON ORE OF NEWFOUNDLAND. By Albert Orion Hayes. Pp. 163, illus. Memoir 78, Canada Department of Mines, Geological Survey Branch, Ottawa.

BIBLIOGRAPHY OF NORTH AMERICAN GEOLOGY FOR 1914, with Subject Index. By John M. Nickles. Pp. 167. Bull. 617, U. S. Geological Survey, Washington.

THE PEAT RESOURCES OF WISCONSIN. By Frederick William Huels. 6½x9½, pp. 274, illus. Bull. XLV, Wisconsin Geological and Natural History Survey, Madison, Wis.

MINERAL RESOURCES OF ALASKA. Report on Progress of Investigations in 1914. By Alfred H. Brooks and others. Pp. 380, illus. Bull. 622, U. S. Geological Survey, Washington.

ABSTRACTS OF CURRENT DECISIONS ON MINES AND MINING, OCTOBER, 1914, TO APRIL, 1915. By J. W. Thompson. Pp. 138. Bull. 101, U. S. Bureau of Mines, Washington.

REPORT OF THE CHIEF INSPECTOR OF MINES IN INDIA, Under the Indian Mines Act (VIII of 1901) for 1914. By G. F. Adams. 8x13, pp. 81, illus. Department of Mines, Calcutta, India.

BIBLIOGRAPHY OF MINNESOTA MINING AND GEOLOGY. By Winifred Gregory. Pp. 157. Bull. 4, University of Minnesota. Minnesota School of Mines, Experiment Station, Minneapolis.

QUINQUENNIAL REVIEW OF THE MINERAL PRODUCTION OF INDIA. By Sir Thomas H. Holland and L. Leigh Fermor. Pp. 296, illus. Vol. XLVI, Records, Geological Survey of India, Calcutta.

MINING AND MINE VENTILATION. A Practical Handbook on the Physics and Chemistry of Mining and Mine Ventilation. By Joseph J. Walsh. 5x7½, pp. 180, illus.; $2. D. Van Nostrand Co., New York.

GEOLOGY OF THE VICTORIA AND SAANICH MAP-AREAS, VANCOUVER ISLAND, B. C. By Chas. H. Clapp. Pp. 143, illus. Memoir 36, Canadian Department of Mines, Geological Survey Branch, Ottawa.

THE YUKON-ALASKA INTERNATIONAL BOUNDARY, BETWEEN PORCUPINE AND YUKON RIVERS. By D. D. Cairnes. Pp. 161, illus. Memoir 67, Canada Department of Mines, Geological Survey Branch, Ottawa.

THE MINING AND QUARRY INDUSTRY OF NEW YORK STATE. Report of Operations and Production During 1914. By D. H. Newland. Pp. 88, paper. Museum Bull. 178. University of the State of New York, Albany.

GEOLOGY AND OIL RESOURCES OF THE WEST BORDER OF THE SAN JOAQUIN VALLEY NORTH OF COALINGA, CALIFORNIA. By Robert Anderson and Robert W. Pack. Pp. 220, illus. Bull. 603, U. S. Geological Survey, Washington.

THE CANBELEGO, BUDGERY AND BUDGERYGAR MINES. Part II of the Cobar Copper and Gold-Field. By E. C. Andrews. 6x9½, pp. 121, illus.; 7s. 6d. Mineral Resources No. 18, Geological Survey, Department of Mines, Sydney, N. S. W.

A GEOLOGICAL RECONNAISSANCE BETWEEN GOLDEN AND KAMLOOPS, B. C., ALONG THE CANADIAN PACIFIC RAILWAY. By Reginald Aldworth Daly. Pp. 260, illus. Memoir 68, Canadian Department of Mines, Geological Survey Branch, Ottawa.

THE WORLD'S SUPPLY OF POTASH. 6¼x9¾, pp. 47, paper; 1s. The Imperial Institute, London, S. W. An account of all the more important sources of potash in the world, including the Stassfurt deposits in Germany, which before the war had an almost complete monopoly of the world's supply.

ESTUDIO DE LA FUERZA HIDRAULICA DE LOS RIOS COLORADO, BLANCO Y RIO DE CHIUTA CON ANTEPROYECTOS PARA LA INSTALACION DE CENTRALES HIDRO-ELECTRICAS. By Victor Sintich. 8½x11½, pp. 34, illus., 16 plates. Sociedad Imprenta y Litografía Universo, Valparaiso, Chile.

THE SAMPLING AND CHEMICAL ANALYSIS OF IRON AND STEEL. By O. Bauer and E. Deiss, translation from the German by William T. Hall and Robert S. Williams. 5½x8, pp. 373, illus.; $3. McGraw-Hill Book Co., New York.

This book was originally a compilation of the methods which have been found reliable after several years' use at the Royal Testing Bureau, Gross-Lichterfelde, Germany, but has been amplified by methods tested by the U. S. Bureau of Standards and in the laboratories of the Massachusetts Institute of Technology.

HENDRICKS' COMMERCIAL REGISTER OF THE UNITED STATES FOR BUYERS AND SELLERS. 7¾x10½ in., pp. 1503, leather; $10. S. E. Hendricks Co., Inc., New York.

The present volume is the twenty-fourth edition of this work, which is published annually. It has been thoroughly revised, entirely reset and much new matter added, which will increase its usefulness. The binding has been changed from cloth to Du Pont "Fabrikoid," making a more handsome book, and we also note an improvement in the quality of paper used.

THE RARE EARTH INDUSTRY. Including the Manufacture of Incandescent Mantles, Pyrophoric Alloys and Electrical Glow Lamps. By Sydney J. Johnstone. Also a chapter on The Industry of Radioactive Substances. By Alexander S. Russell. 6x9¾, pp. 136, illus. D. Appleton & Co., New York.

This is the second of a series of manuals of chemical technology, and is essentially of a practical nature, treating especially of the industrial applications of the rare earths. The pure chemistry of these substances is dealt with only in so far as is necessary for properly understanding the nature and properties of the materials dealt with. The chapters are: Thorium and cerium, titanium, zirconium, tantalum and niobium, tungsten, the incandescent electric glow-lamp industry, uranium, vanadium and the industry of radioactive substances.

DETERMINATIVE MINERALOGY, With tables for the determination of minerals by means of their chemical and physical characters. By J. Volney Lewis. Second edition revised. 5¼x8, pp. 155, illus.; $1.50. John Wiley & Sons, New York, N. Y.

This book has been designed for the use of students in determinative mineralogy and also to meet the needs of the geologist and the mining engineer. The tables give the physical and chemical properties of 380 minerals (which the author says is 100 to 150 more than the current textbooks), while the arrangement is such that unknown minerals may be determined quickly and easily. In the system of determination, the general plan of the Brush-Penfield tables has been followed in the main, but there is much condensation and simplification of procedure.

THE MINERAL INDUSTRY DURING 1914. Volume XXIII. Edited by G. A. Roush. 6x9, pp. 998, illus; $10. McGraw-Hill Book Co., New York.

The twenty-third volume of "The Mineral Industry" is the same in appearance and general plan as its predecessors have been. Indeed, it is remarkable, and a tribute to the foresight of the originators of this publication, that during 23 years there has been so little change of plan. The twenty-third volume brings forward some new contributors, which add freshness to the volume, but in general they stick to the same lines that the writers on the same subject in the past have followed.

The new volume is rather marred by some carelessness in editing. Some of the bibliographies are sadly incomplete, which excites the suspicion that this failing may be general throughout the book. Also, the references to original sources of information in the footnotes are not well done. Many important references are omitted, while minor ones are included, and citations are made to some sources which are not good authorities. The index to the volume is poor, being only a scant 7½ pages.

These criticisms are not offered in any captious way. The defects that we have remarked are trifling in comparison with the great value of "The Mineral Industry" as a book of reference. For a concise summary of progress in the metallurgic arts, for statistics of production and commerce throughout the world, everybody has acquired the habit of turning to this book and usually is able to find what he wants.

THE THEORY AND PRACTICE OF ORE DRESSING. Edward S. Wiard. 6x9, pp. 426, illus.; $4. McGraw-Hill Book Co., New York.

There have been published a good many books on ore dressing, but nothing previously that is just like this one. The treatises in English, heretofore, have been of the descriptive character. The classic of Prof. Richards was much more than that, being encyclopædic. Wiard's new book differs from its predecessors in not being descriptive to any great extent, but rather advisory. That is to say, it tells mill men how they ought to do things, and gives adequate descriptions of the means how and the reasons why, without wasting any time or space upon machines and methods that have been discarded. In other words, this is a treatise by an experienced mill man, who has written a book just as if he were instructing his own assistants or advising a client. It is about the same thing in the art of ore dressing that Peters' first book was in the art of copper smelting.

Now, this book is by no means perfect. There are many things in it with which other mill men will disagree. There are many things that ought to have been treated, which are omitted or else are mentioned but scantily. When we first turned over the pages we were rather shocked to discover how slight was the attention given to the flotation process, but upon referring to the preface we learned that this omission was intentional. The author said, "It was hoped, also, to present some plans and flow sheets of flotation mills, and a large amount of material was collected; but owing to the litigation on flotation processes this information has been furnished confidentially. For this reason the flotation process has not received the mention that its importance warrants."

Here we have once more the bane of that long-drawn vexatious litigation that casts a shade over technical literature like that of the deadly upas tree.

With our eyes open to these shortcomings, however, we think that most mill men will recognize that Mr. Wiard's book is an important contribution to the literature of ore dressing, and is not only refreshing on account of its novelty, but also is of promise with respect to its practical usefulness both to students and the men who are engaged in the actual practice of the art.

RULES AND REGULATIONS FOR METAL MINES. By W. R. Ingalls, James Douglas, J. R. Finlay, J. Parke Channing and John Hays Hammond. Pp. 296. Bull. 75, United States Bureau of Mines, Washington.

It would be difficult to find in this country five men more thoroughly qualified by knowledge, experience and judgment than the members of this committee for the work of which this bulletin is the result. Originally appointed in 1906 as a committee of the American Mining Congress, they spent in preliminary studies, inquiries, tentative reports and publications the following five years, during which they received valuable suggestions from their professional brethren and were appointed a committee of the American Institute of Mining Engineers and of the Mining and Metallurgical Society of America—of each of which organizations they were already members. A fourth instrument of publicity was the "Engineering and Mining Journal," which threw open its columns to the various reports and discussions furnished or called for by the committee. This noteworthy wide and enthusiastic coöperation in such an inquiry is of course highly creditable to the organizations concerned. But it is also a striking testimony to the committee that inspired it. These were competent judges, free from self-interest or professional prejudice, able to comprehend and weigh both criticism and controversy and not ashamed to yield to reasonable opposition. It was worth while to give facts and views to a committee that treated its witnesses as friendly advisers, neither imposing oaths upon them nor flinging curses after them; and the result of its labors, as compared with those of other so-called investigating commissions planned, manned and steered by politicians, is an object lesson in sociology. The first chapter of the volume before me, in which Mr. Ingalls recounts simply and without comment the history of the committee and its investigations, is full of significance to one who can read between the lines.

It was to a work thus auspiciously inaugurated and superintended that the United States Bureau of Mines lent its grateful approval and powerful assistance in 1911 by appointing the individual members of this committee its consulting engineers, facilitating their further labors and finally publishing and circulating their report as Bulletin 75 of the bureau. Its late distinguished director, Dr. Joseph A. Holmes, wrote me, not long before his death, repeating an assurance often given before, that it was his earnest purpose to conduct the Bureau of Mines so as not to oppress individual enterprise by governmental inquisition, interference or control, and especially to keep the bureau out of politics. This report conspicuously illustrates that declaration.

Chapter II constitutes the general report of the committee and Chapter III is the committee's draft of a proposed law. The latter would naturally be regarded as the more important, but I am inclined to give that rank to the former, which contains the committee's opinion of its own work. The following passages indicate this opinion:

> We consider our work to be especially of educational character rather than anything else. It will be useful in three main ways, we think, as follows: (1) As a basis for state legislation. (2) As a basis for private systems of inspection. (3) As a collection of simple rules for the guidance of everybody engaged in mining. . . .
>
> We consider, however, that the chief usefulness of the code of rules that we have formulated will be to small operators, who frequently engage in unsafe practices without knowing that they are unsafe or without thinking about the matter at all. There is a reasonable hope that our report will be of educational value to all mining operators.

Concerning the first two uses of this code mentioned, the committee can already adduce gratifying instances in the codes of states and the systems adopted by large mining companies. In view of the comprehensiveness, technical thoroughness and wide circulation of the committee's code, it is highly probable, not that any legislature or board of directors will adopt it in full, but that no system will be hereafter adopted without a consideration of this one, and that good reason will have to be shown for any omission, addition or departure exhibited by a new system proposed. Legislators and directors cannot hereafter blunder through lack of warning.

The third, the educational, value of this report is greatly enhanced by the comments interspersed through Chapter III and contained in Chapter V—"Discussions of Certain Matters of Practice." Here the conditions to be met are clearly stated and the reasons are given that influenced the committee's adoption or omission of certain rules. This explanation of omissions is specially useful; for an omission might be simply an oversight; and when a drastic or unwise rule is proposed, it is well to know that such a tribunal has considered and condemned it. Moreover, many things are recommended in these chapters as good, though not codified as obligatory.

In short, the code and comments, taken together, constitute an elementary, practical guidebook that ought to be in the hands of every mine operator. If put into his hands, it will certainly open his eyes and thus get into his head, to the great advantage of his brain! It will teach him to value as well as to frame suitable rules; to welcome gladly suitable laws, to oppose bad ones intelligently. For the book is not dry, but fascinating; not abtruse, but practical; not dogmatic, but suggestive and stimulating.

Indeed, the admirable code of this committee is, to my thinking, far more instructive educationally than efficient administratively. Its weakest part is Section 52, "Penalties," which provides that every violation of this law shall be a misdemeanor, punishable, after conviction in a circuit court, by fine not exceeding $500, or imprisonment in the county jail for not more than six months, or both. The same section makes the owner or operator liable for the damage caused by his own act or neglect, or the act or neglect of any superintendent, foreman or hoisting engineer of any mine. Nothing is said about the legal responsibility of employees for anything whatever, and no penalty is provided for any violation of rules by an employee, except that of an indictment and trial by jury in the county court.

The committee frankly confesses this deficiency in the following paragraph (p. 81):

> The committee has endeavored to place the responsibility for certain conditions and the observance of certain requirements upon those who should clearly be responsible—the operator in some instances, and in others the superintendent or the mine foreman. It is recognized that many accidents are due to the miners themselves, owing to carelessness or recklessness, or willful disregard of safety rules; but it is not practicable to penalize the miners for all of such acts. Of course the miner, as well as the operator or superintendent, is personally liable for the doing of an act expressly made unlawful and the doing of which constitutes a misdemeanor. If a miner persistently violates safety requirements, the operator can terminate his employment, if nothing more; or he may, if desired, report the violation of law to the local prosecuting officer or to the mine inspector. Although the men may not be reached in some instances, it is certainly true that a miner injured by the doing of some prohibited thing—that is, in violating the law—would have no recourse against the operator, which is in itself a penalty of a more or less drastic character.

Bearing in mind that the best code is of no use unless strictly enforced and that such an enforcement means the proper punishment of those violations which do not, as well as those which do, result in injury, we must say that the committee's explanation as to penalties shows the weakness of its code in this particular, beyond the need of argument.

For instance, a miner violates Section 51 by giving an electric shock to a comrade "for fun" or by making connection with an electric current so as to get a spark to light his pipe. No harm actually follows, but just such careless acts should be punished without reference to their results. Yet all that the superintendent can do under this code is to tell the district attorney and the grand jury, and get the miner indicted and tried by jury. True, if he "persistently" does the unlawful thing, the operator may discharge him. And finally, if he gets hurt through his own violation of the law, he certainly cannot get damages from his employer.

I am not so sure of the last two propositions as the committee seems to be. I have known superintendents that did not dare to discharge men under such circumstances for fear of a general strike; I have known many a strike that originated in such a discharge; and I have known boards of directors that rebuked their superintendents for "getting into trouble" by trying to enforce discipline. Finally, as to the "certainty" that a violator of the law cannot recover damages for the direct consequence of his own act, a good many people still remember, as I do, the case of an employee that undertook to destroy a mine building with a dynamite bomb, lost an arm through the premature explosion of the bomb, and got from a terrorized jury a verdict for some $17,000 against the company, for "injuries suffered while in its employ." This verdict was, indeed, afterward set aside as contrary to the evidence, but it served to show the value of a jury trial in such a case, place and time.

Admitting, however, all that the committee says under this head, I must still regard its code as highly deficient in penalties. Yet I can hardly characterize this feature as a fault. The most important work of the committee was to point out dangers and remedies; and the highest function of its report will be to convince even employees that the dangers are real and the remedies wise. After that has been accomplished, both the creation and the enforcement of codes will be easy.

R. W. RAYMOND.

Hoover Back to Belgium

Among the passengers sailing for Rotterdam on the Holland-American liner "Nieuw Amsterdam," Nov. 10, says the New York *Times*, was Herbert C. Hoover, chairman of the Commission for Relief in Belgium, who has been in New York for two weeks consulting with his American colleagues on the work to be done during the coming winter. He was accompanied by his wife and his two sons. In an interview just before the steamer sailed, Mr. Hoover said:

We have had to prepare for a year ahead. Belgium has been under occupation and blockade for fifteen months, and there have been no imports and almost complete industrial paralysis and unemployment among the working classes.

The industrial trades in Belgium were hit the hardest. The agriculturists did not suffer so badly. In Brussels from 30 to 40% of the population is on the bread line. In Liege fully half the population is being supported by the relief commission.

We are faced with the task of obtaining for these people a supply of clothing to tide them over the winter. We want about $5,000,000 worth of clothing or clothing material.

The gratitude of the Belgian people to the United States is pathetic. That is the one country in Europe today where America is popular. The people left in Louvain have renamed a public square the Place des Etats Unis, and several streets in Belgium have been named after President Wilson.

Revision of Mining Laws

The convention of mining men that is to be held in Washington on Dec. 16, 1915, at the invitation of, and under the auspices of, the Mining and Metallurgical Society of America, is exciting a good deal of interest, especially in the West, whence numerous delegations have signified their intention to attend.

The headquarters of the society for this meeting will be in the building of the United States Bureau of Mines, where F. F. Sharpless, secretary of the society, will be present on Dec. 15. A book for the registry of persons attending the convention will be open at that time. The society requests that all visitors will register on that day or the following day.

Report of Ray Consolidated

The report of the Ray Consolidated Copper Co., operating at Ray, Ariz., for the third quarter of the year shows a copper production in concentrates of 14,931,388 lb., divided as follows: July, 4,352,571 lb.; August, 5,581,734 lb.; September, 4,997,083 lb. In addition to the copper derived from concentrating ores there was a total of 450,966 lb. of copper contained in ores shipped direct to the smelter. The total amount of ore milled for the quarter was 716,211 dry tons averaging 1.659% of copper, as compared with 679,004 dry tons averaging 1.677% for the previous quarter. The milling costs for the quarter were 56.54c. per ton, as compared with 44.53c. for the previous quarter. The average mining and coarse crushing cost of ores milled for the quarter was 70.835c. per ton, of which 4.279c. was the cost of coarse crushing, leaving the net mining cost 66.556c. per ton. The underground development for the quarter was 12,205 ft.

The average cost per pound of copper produced from milling ores for the quarter, after allowing for smelting losses and applying dividends of the Ray & Gila Valley R.R. and revenues from gold and silver produced, but no other miscellaneous income, was 10.264c. The combined cost per pound of net copper produced from milling and direct shipping ore for the quarter was 10.294c. These costs include all operating and general charges, as well as 12½c. per ton of ore milled, which is applied to the retirement of mine-development costs. This latter charge is equal to 0.621c. per lb. of copper produced from concentrating ores for the period.

The financial results for the quarter were as follows: Net operating income, $802,775; miscellaneous income, $14,171; less bond interest, $35,675, and dividends, $547,802, leaving a net surplus over bond interest and dividend requirements of $233,470.

Costs and earnings were adversely affected during the quarter by labor disturbances. These difficulties were fully and satisfactorily overcome by the middle of July, but the organization did not regain its former efficiency for some time thereafter.

Largest Electric Locomotive in the World

BUTTE CORRESPONDENCE

The first of the electric locomotives for use on the division of the Chicago, Milwaukee & St. Paul lines between Deer Lodge and Three Forks, Mont., arrived in Butte Oct. 25 and was viewed by hundreds of interested spectators. The locomotive is the largest electric railroad engine in the world. It was built by the General Electric Co. and is to be taken to the Coast and exhibited at the principal stations along the route.

The locomotives are 112 ft. long, weigh 284 tons each and are designed to use as high as 3,000-volt direct current. Passenger locomotives are geared to haul 800 tons at 60 mi. per hr., and freight locomotives will haul 2,500 tons trailing, on a 1% grade at a speed of 16 mi. per hr. Each locomotive is driven by 8 motors rated at 375 continuous horsepower each. On down grades the train is controlled by reversing the controller, which changes the motors into generators and sends back to the line about 50% of the energy used in pulling a train up grade. This makes the use of air brakes necessary only in case of emergency. The electrification of the 440 mi. from Harlowtown, Mont., to Avery, Ida., has cost $13,000,000. The first unit completed and to be put in operation will be from Three Forks to Deer Lodge, running through Butte. On Oct. 25, a dozen officials of the Milwaukee and of the Butte, Anaconda & Pacific, with a few guests, made a very successful trial run from Butte to Anaconda and back over the B. A. & P. line. Tests will soon be made with the new locomotives over the line between Deer Lodge and Three Forks, and trains will be running over that division under electrical power by Jan. 1, 1916.

Japanese Mineral Production in August, 1915

Japanese mineral production during August, 1915, according to the Department of Agriculture and Commerce in Tokyo was as follows: Gold, 742,858 kg.; silver, 11,974,036 kg.; copper, 5,667,780 metric tons; iron, 4,986,645 metric tons; coal, 1,290,722 metric tons; crude oil, 43,226,640 liters; sulphur, 6,648,963 metric tons.

Coal and sulphur show a decrease compared with 1914; all others show increases.

Editorials

The Metal Markets

The middle of November sees all of the metal markets in a blaze of glory. In each case there is a large production, probably a phenomenal production, but the demand is so large that the output is readily absorbed on a scale upward. Verily, this is a bull market in the metals.

In copper the strike at the Nichols refinery, reducing the American production of electrolytic copper by about a million pounds a day, gave the market the fillip it needed. Buyers began to think that no matter how plentiful copper might be next year, when Chuquicamata and Inspiration are expected to be going real good, for a while copper might be scarce, especially in view of the facts that producers were well sold ahead and had no great accumulation of stocks. Their thoughts of this nature prompted them to action, and they bought freely.

Some characteristics of the existing copper market are deserving of comment. Buyers appear to have abandoned the policy of coming into the market together, contracting for huge blocks, and then remaining away for a long time. During the last month there has been good business from day to day, each buyer playing his own hand and contracting for copper as he thought it wise to do. On the other hand, producers have displayed no tendency to dangle copper over the buyers' heads, but have supplied it liberally on a scale upward. Not yet has copper been put to an extravagant price.

Within a month the price for lead has risen from 4½c. to 5¼c., the successive advances following large and satisfactory selling at each previous price. The demand for lead, both for domestic consumption and for export, continues large, but in this metal, as in copper, the producers have followed the policy of making hay while the sun is shining and have deemed it wise to convert lead into money as fast as they could.

The demand for spelter appears to be insatiable, for in spite of the rapidly increasing production prices have risen again. The great mystery is how so much of it is being used, for the domestic galvanizing business for peaceful purposes continues all but paralyzed.

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Great Britain's Backwardness in Metallurgy

The handicap under which Great Britain and her colonies labor, owing to their small participation in the metallurgical industries of the world—iron and steel excepted—continues to exercise the British press. In the *Journal* of Nov. 13 were reproduced excerpts from a recent article in the *Statist,* which is more rational and better informed than most of its contemporaries. The complaint particularly expressed in this article is against the sending of raw copper from Great Britain to the United States for refining.

This movement, which is no new thing, has not deprived Great Britain of any needed supplies in her time of war, nor has it advanced the price to her. The copper refining business is highly competitive—American, Japanese, Australian, and other refiners meeting in a free field. All that Great Britain loses is the profits that would accrue to her from doing more of this work at home. The reason that she does not do it at home is that her metallurgists are backward, while the blight of labor inefficiency is over everything. In a previous article on this subject, the *Journal* suggested as a fruitful subject for inquiry the reason why Great Britain has been able to maintain her prestige in iron and steel while falling so far behind in copper, lead and zinc.

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Opportunities for Unemployed Mining Engineers

Owing to numerous untoward conditions that have obtained in the mining industry for the last few years, there has been a growing number of competent mining engineers who have been finding great difficulty in obtaining employment. This has been adverted to several times in these columns and has aroused considerable discussion. Although the conditions of unemployment have been ameliorated to a certain extent by the present boom in mining, no permanent solution of the problem has been found, and recurrence of these periods of unemployment for mining engineers is a probability.

The field for the independent consulting mining engineer, which was such an attractive one a few years ago, has narrowed almost to the vanishing point. All of the larger mining concerns, which can afford to pay consulting engineers' fees commensurate with the talent required, maintain their own staffs who are constantly employed with the almost innumerable propositions being put to them every year. There is also in these large companies a growing tendency toward promotion and elevation of their own engineers, so that it is increasingly difficult for an outsider to break into these attractive organizations.

Therefore many competent mining engineers are confronted with the question of where to look or what to do. A striking and interesting illustration of the solution of this problem, in one instance, is at hand and should furnish food for thought for others.

About one year ago ten Colorado mining engineers, who had plenty of idle time, organized themselves into a leasing and mining company, believing that if the advice of a competent experienced engineer is sufficient basis for the expenditure of large sums by experienced eastern mining investors, it ought to be sufficient basis for the investment of the engineer's own money. After much consideration of many offerings, a good lease, which each agreed was one he would recommend to a client, was selected near Denver and work was commenced on a comparatively small scale, financed by the engineers themselves, who of course provided the engineering talent for the proposition. Within a very short time they had

found what they went after, and further developments made a paying proposition of the venture. The work is still going on with good results.

If such a scheme were to be as widely adopted as it should be, there would be a dearth instead of a surplus of unemployed mining engineers. There are plenty of promising opportunities, both in new prospects and in old mines whose ores, formerly too low-grade or too complex to be successfully treated, are now profitable. These opportunities cannot be safely judged except by the trained engineer, and this very fact more often brings them to the notice of the engineer earlier than to the promoter or investor. That the engineers have not taken up this independent work and made themselves producers is partly owing to the fact that, when confronted with unemployment, which from previous experience the engineer may know is likely to be quite long, he hesitates about making the venture. However, in one small district, for example, there are more than forty leasers who are making more than $300 a month each, on average veins of ore, with no capital investment. And there are plenty of localities and prospects where a few thousand dollars judiciously expended would at least give a fair run for the money.

The engineers' lease on the Florence, in Goldfield seven or eight years ago, is another instance where engineers took hold of an abandoned lease with the greatest success, although of course in this case it was enlarged by the fact that they were after and found the rather exceptional picture rock which was common to that section of Goldfield in the early days.

Let the engineers grub-stake themselves by association or secure a grub-stake from an outsider and become producers instead of stragglers or farmers.

There is another field for the mining engineer that has sufficient capital to keep himself going for a little while, say 12 to 18 months. If he is not already acquainted with several mining propositions that are being run very unprofitably, a short trip, which would be within his means, would doubtless reveal to him one or more small mining propositions that were producing, say, in the neighborhood of $100,000 a year, whose operations were being sadly bungled. There are hundreds of mining operations being carried on under the direct supervision of men that are not engineers and that have little executive ability and that are not only not producing results but have very little likelihood of ever being able to do so, although the opportunity is there if the right talent be applied. The unemployed engineer could well afford to make a proposition to undertake the handling of such an operation on a contingent basis—not to receive any salary during the period, but to receive a compensation commensurate with the savings or increased profits which he feels his ability will enable him to make over the present poor methods employed. As a consulting engineer he would be staking his reputation, at least so far as his then clients were concerned, on the advice that he would give them as to the methods for changing or improving their mining and milling methods. He would not be doing more or less than this if he assumed this responsibility himself on a contingent basis.

A working arrangement of this kind would be not only mutually advantageous, but also would be as welcome to one party as to the other. A mine that is producing $100,000 a year and that at a loss, will almost never have an engineering staff, nor will it have a head who will feel justified in incurring the expense of employing a consulting engineer to point out where the flaws are that result in unprofitable operations. A mining proposition cannot go on losing money forever, and the limit is much more quickly reached in a mining operation of the size that we have assumed. Therefore the consulting engineer who would attach himself to the company on a contingent-fee basis would be not only a very welcome acquisition from the standpoint of the controlling interests, but under the conditions would be stimulated to put forth his best and most energetic efforts; and there is no doubt that hundreds of mining operations throughout the country which under present conditions are foredoomed to disaster could thus be turned into profitable money-making properties, to the gratification of both parties to the contract.

If these two methods of turning unemployment into employment were to be adopted by any considerable percentage of the mining engineers looking for openings, there would be another great advantage along broad general lines, but in a distinctly different direction. One or two small mines in a district employing, or having in this manner associated with it, a mining engineer would stimulate the other properties that were on a similar basis, both as to size and quality of operations, to make some such arrangement. The eventual result would be that those mining operations, in general, that are conducted on a moderately small scale would be toned up and we should see far fewer monuments to poor engineering and blasted hopes than are now so common in almost every mining district.

Respirators vs. Water Sprays

The danger from the inhalation of rock dust by miners is becoming more and more recognized. The drawing of fine particles of dust into the lungs is not good for the lungs, no matter what be the kind of dust, although certain kinds are less injurious than others. The worst kind is, without any doubt, that which arises when flint or chert is pulverized, as in drilling upwardly pointed holes. The sharp angular fragments, infinitesimal though they be, produce an affection known as silicosis, the sufferer from which is especially subject to tuberculosis. The men working in the zinc mines of the Joplin district of Missouri and in the gold-quartz mines of California seem to be especially subject to this danger.

There are two principal means for the amelioration of bad conditions resulting from the operation of such mines: One is for the miners to wear respirators, in order to filter the dust from the air they breathe. The other is to lay the dust by directing a water spray upon the mouth of the hole being drilled or to use the hollow steel water-drill.

The compulsory use of respirators has been tried by some enlightened operators in the Joplin district, but without success, for the reason that the miners would not wear them except when the shift boss was looking on. At all other times the free and independent miner preferred to be at liberty to converse with his partner, whistle, chew tobacco and expectorate, or do whatever he pleased, rather than protect himself against a danger whereof the consequences were not, anyhow, immediate, so far as he could see. The same aversion used to be observed in

dry-crushing mills, wherein the dust-laden atmosphere was much worse than it is in any mine. No matter how many respirators might be provided, the men would not use them. Sometimes they would tie a wet sponge over the mouth, but generally they dispensed with all protection and tried to lead a merry life, if a short one.

The California mine operators, on the other hand, appear to be having better success in inducing the men to wear respirators than in persuading them to use water in connection with the drilling. The men claim that the use of water in steeply inclined or vertical raises makes some of them very dangerous by rendering the timber slippery and the ground unsafe. Also, they allege that the men who use water in such raises become wet to the skin in a short time and are troubled by rheumatism. The average California miner dreads rheumatism even more than tuberculosis, and as to the latter he does not realize that breathing rock dust may cause it.

This is one of the evils of the mining occupation that cannot be cured effectually by rules and regulations, no matter how many policemen may be appointed to enforce them. The real remedy is education, making the miners themselves see the dangers so clearly that they will want to protect themselves.

BY THE WAY

Recent news dispatches affirm that after a lapse of about two years the service of Pullman cars from Laredo to Mexico City has been resumed. Well and good. But peace and prosperity will seem more assured when the service of man-pushed ore cars is resumed throughout the Sierra Madre.

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The Ford process for producing castings direct "at one heat," concerning which some extraordinary statements appeared in the daily papers, consists chiefly in the delivery of molten pig iron from the blast furnace to the electric furnace through a mixer in the same way as molten iron is delivered to the openhearth steel furnace.

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"The hottest summer known in Alaska, melting the snow on mountain tops for first time since purchase of the territory from Russia, together with the action of a receding glacier, uncovered and exposed near Valdez within 11 mi. of tidewater what is said to be greatest low-grade copper-ore deposit in Alaska," says the Boston *News Bureau*. "Ore zone is 1,000 ft. wide and 3 mi. long. Traversing it are eight strata of schist and quartzite from 24 to 200 ft. in width, freely impregnated with chalcopyrite, carrying values of from 2% to 9% copper. Also in same belt is found great quantity of malachite ore carrying copper value of $70 a ton." There is a long, cold, hard winter coming, however.

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That all the smelter chemists are not rich is merely because they do not know anything to speak of, which is shown by the following quotation from the Salt Lake *Herald-Republican:* "In the smelter fumes are scores of rare materials which as yet the smelter chemists know nothing about. It is probable that in the smelter fumes there are greater profits than in the metals that are being smelted. Take as an example the Tennessee Copper ores—and there are thousands of tons of ore almost identical in Utah—or at least are treated in the Utah smelters. In making its copper the Tennessee Copper saves sulphuric acid, nitric acid, picric acid, tri-nitro-toluol, and other products which will sell under contract during the year for $11,000,000, on which it is declared there is a profit of at least 50%. Using this as a basis for figuring, Utah could produce at its present rate of making copper, $165,000,000 gross. Then there are all the byproducts from the lead-silver stacks which have not yet been taken into consideration. Figuring profits at 50%, the return would be $82,500,000." Let's all start for Utah and get rich.

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The camp of Eureka, Nev., at the height of its activity had a population close to five figures. Austin at this time was compelled to take a back seat; and Pioche crawled into her shell; for twenty years Eureka was the whole show and rejoiced in her prominence. Everything was as rosy as a Flemish sunset; and though Eureka could not hope to rival Pioche in the matter of "men for breakfast," she had enough to maintain a respectable average. Prosperity filled the cup between 1870 and 1890; but after that adversity took to mixing the drinks for the camp—each one a little bit worse than the one which preceded it, writes Charles E. Van Loan in the *Saturday Evening Post.* For the benefit of those who take their narrative sprinkled with names and dates and vital statistics, Mr. Van Loan gives the following thumbnail history of Nevada's lead camp: In 1864 five prospectors set out from Austin, following the Pony Express route eastward to the mountains. On the western slope of the range they found ore that puzzled them; and as they could learn nothing of it by examination they put fragments of it into their camp fire. The result was an immediate flow of whitish metal. The prospectors argued long over it; those who claimed it was silver were told that it was too soft, and those who thought it was lead were told that it was too hard. Both sides were correct—it was a combination of both metals. The news of the strike created little or no excitement. Nevada, with one eye on the tremendous output of the Comstock Lode, could not be bothered with anything so commonplace as a lead mine with silver trimmings. For several years after discovery the district languished while unsuccessful attempts were made to smelt the silver-lead ore; but in 1869 draft and blast furnaces solved the problem, and the camp of Eureka bounced out on the map of the state as the metropolis of eastern Nevada, greatly to the disgust of Pioche, which was just beginning to sit up and howl, a day's journey to the southeast. Foreign capital became interested in the new district. Two mines on Ruby Hill were sold to the Eureka Consolidated Mining Co., of San Francisco, and an English concern, the Richmond Mining Co., bought adjoining property and, with characteristic British thoroughness, set about developing it. The Eureka Consolidated erected its furnaces at the lower end of Main St., and the Richmond works went up at the other. In 1875 the "Slim Princess" came puffing into town from Palisade, linking Eureka to the outside world, and prosperity came in with a whoop and a yell, bringing the nine graveyards with it. . . . As in Virginia City and elsewhere, nobody doubted the future—good times, they thought, would last forever; but it seems to be true that the more you take out of the ground the less you leave in.

PERSONALS

S. A. Worcester is at Ouray, Colorado.

J. Power Hutchins has been in the Altai region in Siberia.

George A. Denny, recently in Mexico, has gone to the Transvaal.

H. C. Enos has just returned from Central America and will spend several weeks in Utah.

Frank H. Probert left San Francisco Nov. 13 to visit the new gold camp at Oatman, Arizona.

Harold B. Gleeson is manager of the Mawchi mines in Burma, succeeding George Macfarlane.

W. M. Archibald has succeeded J. M. Turnbull as manager of the Consolidated Mining and Smelting Co. at Trail, in British Columbia.

J. D. Galloway, assistant provincial mineralogist, has been examining mining properties in the Big Bend and Slocan districts of British Columbia.

W. Hunnewell, of Wellesley, Mass., and C. W. Hanford, of New York, both connected with the Calumet & Hecla interests, visited the Michigan copper mines this week.

Taylor Allderdice, vice-president of the National Tube Co., Pittsburgh, has been appointed a member of the state board of education of Pennsylvania by Gov. Martin G. Brumbaugh.

Dr. Henry M. Payne was in Petrograd on Oct. 16, and expected to leave there early in November for London, by way of Sweden and Norway. He will sail for America in December.

H. F. Fay, president of the Mayflower and Old Colony properties near Houghton, Mich., accompanied by W. L. Frost, of Brookline, Mass., is in Michigan from Boston, visiting the properties.

R. T. McKeever, former manager of the Copper Range railway, but later connected with the firm of Logan & Bryan in Chicago, is now associated with Hornblower & Weeks in their Chicago office.

George B. Holderer, who recently returned from South America, has been made general manager of the Furlough Development Co., which is developing a copper property near Wickenburg, Arizona.

D. G. Kerr and McGilvary Shiras, of Pittsburgh, Penn., have been in the Lake Superior district for 10 days, looking over the mines of the Oliver Iron Mining Co., in company with the officials of that company.

R. L. Agassiz, president of the Calumet & Hecla and various subsidiaries, has returned to Boston, after an extended visit at the mines in Michigan. He was accompanied by Shaw McKane, of the eastern management.

Albert Sauveur, professor of metallurgy and metallography of Harvard University, presented an illustrated lecture on "The Industrial Importance of Metallography" at the Exchange Club, Boston, Nov. 10, before the NewEngland Foundrymen's Association.

John Saam, who, for the past 12 years has been assistant clerk at the Mohawk mine, resigned last week to become clerk and purchasing agent for the White Pine Extension, one of the Stanton properties recently operating in Ontonagon county, Michigan.

E. W. Maynard, who has been in charge of the Atlas Powder Co.'s plant at Senter, near Houghton, Mich., ever since its erection in 1910, has been promoted to the superintendency of the company's plant near San Francisco. He is succeeded by E. C. Eddy of New Jersey.

Frank M. Leland, manager of the Balaklala, after attending the mining congress and other engineering conventions at San Francisco and visiting the Panama-Pacific Exposition, is devoting some time to the affairs of the Balaklala at Coram, Calif. The mine is shipping ore to the Mammoth smeltery, and keeping up the demand for 250 to 300 tons a day.

John MacGinniss of Butte, George S. Deeks of New York, and Al Frank of the Ohio Copper Co., Bingham, Utah, have just visited their Delaware property at Vernon, Nev., in company with General Manager H. H. Hunter of Lovelock. The result of the trip of inspection will be the institution of immediate development work to explore the Delaware veins at depth.

W. C. Ralston is preparing for a return trip to New York, where he has established an office at 25 Broad St. The purpose of the New York office is to attract Eastern men to the advantages of mining investments in California, Nevada and Alaska. Mr. Ralston has learned the futility of attracting California men to the possibilities of their home state in the industry of mining, and realizes that the development of the large mining properties has been the work of Eastern and European men.

OBITUARY

Thomas E. Frakes died at Sutter Creek, Calif., in October, at the age of 82 years. He crossed the plains shortly after the Marshall gold discovery at Coloma, and settled in Amador County, where he engaged in mining. In later years he gave up the mining business and carried on an extensive dairy ranch.

William H. Davis died at Alameda, Calif., on Nov. 7. He was born in Boston in 1831 and crossed the plains to California, settling in Eldorado County in 1852, where he engaged in mining. In 1859 he established the Union Lumber Co. in San Francisco. He was the last surviving charter member of Excelsior Lodge of Masons in San Francisco.

Professor Vivian B. Lewes died Oct. 16, at Mold, England, aed 64 years. He was for many years professor of chemistry at the Royal Naval College and was engaged in many important investigations, such as the chemistry of coal and its combustion, spontaneous combustion, oils, boiler corrosion, etc. He was also for a number of years chief gas examiner for the city of London. He was the author of several books on chemistry and combustion.

Henry Benjamin Smith died at Joliet, Ill., Nov. 7, aged 53 years. He had been in the Joliet Steel Works since he was a boy, entering the service of the old Joliet Steel Co.—later merged in the Illinois Steel Co.—in 1878 and gradually attaining a responsible position. He was one of the first to take up questions of safety work in the plants of the company and in 1893 was appointed supervisor of safety and labor, which position he had held ever since doing notable work in the cause of accident prevention.

Nicholas Treweek, of Salt Lake City, Utah, died in New York Nov. 8, as the result of an operation for throat trouble. He was born in Cornwall, England, and came to the United States when 20 years old. After a few years spent in Pennsylvania he settled in Utah and engaged in mining operations. He was identified with the opening and operation of many mines, notable among them being the Wabash at Park City, several properties in the Big Cottonwood district in Utah, the Lucky Boy in Idaho and several British Columbia mines. He was well known throughout Utah and was prominent as a Mason and a member of other orders. He leaves a widow, two sons and two daughters, all residents of Salt Lake.

Sir Andrew Noble died at Ardkinglas, Scotland, Oct. 22, aged 84 years. He was born in Greenock, was educated at Edinburgh and at Woolwich. He served for 15 years in the Royal Artillery and became an expert in ordnance and ammunition. After leaving the army, he became connected with the Elswick works at Newcastle, with which he continued for over 40 years, being for some time head of the great firm of Armstrong, Whitworth & Co. He was concerned in a number of important investigations, especially one on the products of combustion of powder, which he conducted with the late Sir Frederick Abel. He was a member of many learned societies and had received medals and other honors from a number of them.

INDUSTRIAL NEWS

The Anaconda Copper Mining Co. has ordered three additional 10-ft. by 48-in. Hardinge mills.

Nineteen parcels of land (an entire city block) have just been acquired by The Cleveland Galvanizing Works Co., Cleveland, Ohio, adjacent to its present location which is in the heart of the city.

The American Cyanamid Co. now has its general offices at No. 200 Fifth Avenue, New York. The Nashville and Buffalo offices were discontinued on Oct. 1. A southern office is maintained at 604 Walton Building, Atlanta, Ga.

The Salt Lake office of the Mine and Smelter Supply Co. has received orders for No. 64½ Marcy mills for the following companies: Silver King Coalition Mines Co., Park City, Utah, 2; Duquesne Mining Co., Duquesne, Ariz., 1; Red Banks Mining Co., H. C. Callahan, Bagby, Calif., 1.

TRADE CATALOGS

Newport Rolling Mill Co., Newport, Ky. Circular. Genuine Open Hearth Iron. Illus., 9x15 inches.

Mesta Machine Co., Pittsburgh, Penn. Bulletin R. Mesta Barometric Condensers. 8 pp., illus., 9x6¼ inches.

B. F. Sturtevant Co., Hyde Park, Boston, Mass. Bulletin No. 221. Electric Fans. 24 pp., illus., 6½x9 inches.

The Denver Fire Clay Co., Denver, Colo. Folder. The Case Oil-Fired Tilting Crucible Furnace. Illustrated.

The Colorado Iron Works Co., Denver, Colo. Pamphlet No. 24-B. The Akins Classifier. 16 pp., illus., 9x6 inches.

Stephens-Adamson Mfg. Co., Aurora, Ill. Catalog No. 22. "S-A" Pivoted Bucket Carrier. 84 pp., illus., 6x9 inches.

The Denver Fire Clay Co., Denver, Colo. Bulletin No. 100. Crucibles, Muffles, Scorifiers, etc. 18 pp., illus., 7x10 inches.

The Scranton Pump Co., Scranton, Penn. Bulletin No. 103. Jet Condensers and Vacuum Pumps. 12 pp., illus., 6x9 inches.

Morse Chain Co., Ithaca, N. Y. "Chain of Evidence." Publication No. 14. Large Power Drives. 20 pp., illus., 6x9 inches.

Kingsford Foundry and Machine Works, Oswego, N. Y. Catalog No. 18. Turbine Pumps, Type L. 22 pp., 6x9 inches illus.

Asbestos Protected Metal Co., Pittsburgh, Penn. Bulletin No. 56. "Waugh" Glazing Construction. 20 pp., illus., 8x10½ inches.

A. S. Cameron Steam Pump Works, 11 Broadway, New York. Bulletin No. 154. Centrifugal Pumps. 16 pp., illus., 6x9 inches.

The Texas Co., Lubricating Division, 17 Battery Place, New York, N. Y. Booklet. Lubrication Vol. III, No. I. 16 pp., illus., 5½x8½ inches.

Wilson-Maeulen Co., Wales Ave. & E. 142d St., New York. Catalog T-15. The "Tapalog"—Recording Pyrometer. 8 pp., illus., 8x10½ inches.

Pitman, César & Co., 25 Victoria St., London, S. W. England. Catalog. Water Turbines and Pelton Wheels. 16 pp., illus., 11x8½ inches.

Edison Storage Battery Co., Orange, N. J. Bulletin No. 1125. Edison Storage Batteries and Some of Their Applications. 24 pp., illus., 6x9 inches.

General Electric Co., Schenectady, N. Y. Bulletin No. 44,005. Line Material and Rail Bonds for Mine and Industrial Haulage. 76 pp., illus., 8x10½ inches.

Westinghouse Electric & Mfg. Co., E. Pittsburgh, Penn. Circular No. 1536. Alternating-Current Water-Wheel Generators. 32 pp., illus., 8x10½ inches.

Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin No. 1432-A. Stamp Mills and Accessory Machinery for Free-milling Gold Ores. 52 pp., illus., 8x10½ inches.

Hauck Mfg. Co., 140 Livingston St., Brooklyn, N. Y. Bulletin No. 60. Application of Hauck Oil Burners and Torches in Different Shops. 16 pp., illus., 6x9 inches.

Ingersoll-Rand Co., 11 Broadway, New York. Catalog No. 76. "Water Lifted by Compressed Air." 80 pp., illus., 6x9 in. Form No. 9201. Calyx Core Drills. 128 pp., illus., 6x9 inches.

Alberger Pump & Condenser Co., 140 Cedar St., New York. Bulletin No. 21. Alberger Centrifugal Boiler-Feed Pumps, Alberger-Curtis Steam Turbines. 28 pp., illus., 6x9 inches.

Oliver Continuous Filter Co., San Francisco, Calif. Pamphlet. "Oil Flotation—Oliver Filtration." Description and list of installations of Oliver continuous filters. 6 pp., illus., 6x9 inches.

Chicago Pneumatic Tool Co., Fisher Building, Chicago, Ill. Booklet No. 213. Simplate Flat Disc Valves. 10 pp., illus., 3½x6 inches. Bulletin No. 126. "Hummer" Self-Rotating Hammer Drills. 28 pp., illus., 6x9 inches.

The Williams Patent Crusher and Pulverizer Co., St. Louis, Mo. Bulletin No. 107. Durability of Williams Crushers and Pulverizers. 8 pp., illus., 12x9½ in. Bulletin No. 112. Conglomerate Ore. 8 pp., illus., 12x9½ inches.

A. M. Byers Co., Pittsburgh, Penn. Bulletin 26. Byers Genuine Wrought Iron Pipe. 24 pp., illus., 11x8½ inches.

This bulletin contains useful information about Byers pipe, such as its resistance to corrosion, fabricating and welding qualities, etc. Complete tables showing dimensions, areas, and hydrostatic tests are given.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

ANNEALING FURNACE. John E. White, Tarentum, Penn., assignor to West Penn Steel Co., Brackenridge, Penn. (U. S. No. 1,158,760; Nov. 2, 1915.)

CARS—Safety Device for Mining Cars. William Kowalski, Chicago, Ill. (U. S. No. 1,159,050; Nov. 2, 1915.)

CHARGING CAR. Frank D. Carney and Richard V. McKay, Steelton, Penn. (U. S. No. 1,158,982; Nov. 2, 1915.)

CONCENTRATOR HEAD MOTION. William H. Reagan, Jr., and John R. McMurray, Miami, Ariz. (U. S. No. 1,159,272; Nov. 2, 1915.)

CONVEYING, SORTING AND SCREENING SYSTEM. Gilbert Tollefson, Bagley, Minn. (U. S. No. 1,159,134; Nov. 2, 1915.)

CYANIDING—Treatment of Ores by the Cyanide Process. Hugh M. Leslie, Glasgow, Scotland. (U. S. No. 1,158,513; Nov. 2, 1915.)

DRILL—Rock-Drill Attachment. Harry H. Hughes, Poultney, Vt. (U. S. No. 1,159,034; Nov. 2, 1915.)

DRILL-SHARPENING APPARATUS. Arthur H. Skaer, Denver, Colo., assignor to The Denver Rock Drill Manufacturing Co., Denver, Colo. (U. S. No. 1,159,722; Nov. 9, 1915.)

DRILLS—Improvements in Power-Driven Rock Drills. M. Kellow, Penrhyndeudraeth, N. Wales. (Brit. No. 13,067 of 1914.)

ELECTRIC FURNACE. Percy A. Boeck, Worcester, Mass., assignor to Norton Co., Worcester, Mass. (U. S. No. 1,158,971; and 1,158,972; Nov. 2, 1915.)

FLOTATION—Separation of Minerals by Flotation. Lewis G. Rowand, Brooklyn, N. Y., assignor to New Jersey Zinc Co., New York, N. Y. (U. S. No. 1,159,713; Nov. 9, 1915.)

FULLER'S EARTH—Earth-Treating Process and Product. Michael J. Welsh, Philadelphia, Penn., assignor to The Atlantic Refining Co., Philadelphia, Penn. (U. S. No. 1,159,450; Nov. 9, 1915.)

FURNACE and Allied Structure. Utley Wedge, Ardmore, Penn. (U. S. No. 1,159,141; Nov. 2, 1915.)

FURNACE-DOOR LINING—Edward S. Cline and Edward C. Meier, Phœnixville, Penn. (U. S. No. 1,159,898; Nov. 9, 1915.)

FURNACE LINING. Albert P. Meyer, Aspinwall, Penn., assignor to Allen S. Davison Company, Pittsburgh, Penn. (U. S. No. 1,160,085; Nov. 9, 1915.)

JIG. Walter S. Tower and Peter D. Camphuis, Wallace, Idaho. (U. S. No. 1,159,295; Nov. 2, 1915.)

LEAD ALLOYS Containing a Plurality of the Metals of the Alkaline Earths. Francis C. Frary, Minneapolis, and Sterling N. Temple, St. Paul, Minn.; said Temple assignor of one-sixth of the whole right to said Frary. (U. S. No. 1,158,672; Nov. 2, 1915.)

METAL-MELTING FURNACE. Oro J. Warman, Cincinnati, Ohio, assignor, by mesne assignments, to Buckeye Products Co., Cincinnati, Ohio. (U. S. No. 1,458,875; Nov. 2, 1915.)

MINE-CAR LUBRICATOR. Charles Goyn, Gorham, Colo. (U. S. No. 1,160,067; Nov. 9, 1915.)

NITROGEN COMPOUNDS—Process of Producing Nitrogen Compounds of Aluminum and Alkali or Alkaline-Earth Metals. Dmitry Alexandrowitch Peniakoff, Brussels, Belgium. (U. S. No. 1,159,989; Nov. 9, 1915.)

POTASH—Process of Recovering Potash from Potassium-Iron Silicates. Harry P. Bassett, Catonsville, Md., assignor to The Spar Chemical Co., Baltimore, Md. (U. S. No. 1,159,464; Nov. 9, 1915.)

REFRACTORY MATERIAL—Highly Refractory Material and Process for Making It. August Pfaff, Freiberg, Germany. (U. S. No. 1,159,264; Nov. 2, 1915.)

SCREEN—Shaking Screen. Paul M. Kuehn, Baltimore, Md., assignor to Bartlett Hayward Co., Baltimore, Md. (U. S. No. 1,159,317; Nov. 2, 1915.)

SCREENING APPARATUS. Paul M. Kuehn, Baltimore, Md., assignor to Bartlett Hayward Co., Baltimore, Md. (U. S. No. 1,159,318; Nov. 2, 1915.)

SEPARATION—An Improvement in the Magnetic Separation of Ores. Graf Botho Schwerin, Frankfort-on-the-Main, Germany. (Brit. No. 19,313 of 1914.)

SULPHATING—Method of Sulphating Materials. Henry B. Hovland, Duluth, and George B. Frankforter, Minneapolis, Minn.; said Frankforter assignor to said Hovland. (U. S. No. 1,159,032 and 33; Nov. 2, 1915.)

SULPHIDE ORES—Imported Method for the Recovery of Cuprous Sulphide from Ores and the Like. Metals Research Co., New York City. (Brit. No. 143 of 1915.)

SULPHIDIZING—Method of Sulphidizing Metals. Henry B. Hovland, Duluth, Minn. (U. S. No. 1,159,942; Nov. 9, 1915.)

TRANSIT. Adolph Lietz, San Rafael, Calif. (U. S. No. 1,159,510; Nov. 9, 1915.)

ZINC—Device for Removing Residue from Retorts. Nicholas L. Heinz, La Salle, Ill. (U. S. No. 1,160,077; Nov. 9, 1915.)

ZINC—Method for the Treatment of Zinc Ore or Zinc-Bearing Material. Sewall Truax, Canon City, Colo., assignor to Granadena Mining Co. (U. S. No. 1,155,628; Oct. 5, 1915.)

ZIRCONIUM OXIDE—Method of Producing White Zirconium Oxide Free of Iron. Paul Askenasy, Karlsruhe, Germany, assignor to Chemisch Metallurgische Industriegesellschaft mit beschränkter Haftung, Berlin, Germany. (U. S. No. 1,158,769; Nov. 2, 1915.)

Editorial Correspondence

SAN FRANCISCO—Nov. 10

California Metal Producers' Association—At the recent annual meeting at San Francisco the following officers were elected: President, Albert Burch; vice-presidents, G. W. Metcalfe, E. C. Hutchinson; secretary-treasurer, R. I. Kerr; executive committee, G. W. Starr, C. E. Knox, N. Cleaveland, S. W. Mudd.

The Comstock Mines are shaking off the ghostly raiment with which a recent magazine story invested the town of Virginia City. In the last half of October and the first quarter of November, Union Consolidated and Sierra Nevada explored high-grade orebodies on the 2,500 level. The ore in the Comstock north-side mines has been running at from $8 to $12 per ton, with an occasional shoot of higher grade. Recent disclosures have increased the value to a probable average of $40 per ton. As early as the week ended Oct. 16, Union Consolidated saved 83 cars average $49 per ton and 35 cars which averaged $63 per ton. In the same week Sierra Nevada ran into ore worth $11 per ton and in the week ended Oct. 23 the face of the north drift of the 2,500-ft. level showed ore running as high as $130 per ton; with an encouraging outlook for a large high-grade orebody in this neighborhood. In the same week the north end of No. 1 stope of the Union 2,500 level was in ore averaging $79 per ton. At another point samples showed $89 per ton. The ore saved from this stope averaged $26.90 per ton. Six feet of $50 ore was found in No. 3 stope of the Union in the week ended Oct. 30, and in the same week Sierra Nevada extended the north drift 10 ft. into ore averaging $32.34 per ton, while the face was in $85 rock. In the first week in November, Sierra Nevada saved ore averaging $33 per ton and Union Consolidated found various grades running $13.72, $24.60 and $45.16. Herman Zadig, of San Francisco, one of the directors, returning from Virginia City after a visit to the north-end mines, stated that the recent development in the Sierra Nevada proved the contention of himself and other directors that the Comstock was not dead. He considered this disclosure of high-grade ore of great importance, because it was in the Sierra Nevada in 1878 that the bonanza people thought they had found another orebody similar to the one that was then being worked in Consolidated Virginia. Mr. Zadig and Mr. Slosson and Mr. Ralston have been sanguine that large orebodies would be found in the 2,500 and 2,700 levels. In their opinion the work now being done on 2,500 level proves to a certainty that there is a chance of extensive orebodies at this point. It seems reasonable that if the early-day management had believed in 1878 that ore persisted in large bodies to the 2,700 level, they would have mined it because silver was then worth $1.29. However, without assuming to disagree with these opinions it may be taken as indisputable that Fair and Flood and Mackay did, and left undone, many things which were incomprehensible to mining men of that day. The past performances of the past-masters of Comstock mining are not of such great interest to the present-day management as the fact that the Comstock ghost has begun to walk again.

DENVER—Nov. 11

The Phenomenal Demand for Tungsten has created conditions in Boulder County that, for a brief time, threatened the organization of a miners' union. The idea, it is believed, was thwarted at its inception by prompt action of the leading mine operators in establishing a new and uniform wage scale for miners at 45c. per hour. The regular wage has been $3 for eight hours. The "boom" continues unabated at Nederland.

The American Metals Producing Co., controlled by E. S. Moulton and G. Whitney Adams, is attracting attention by its activities at Black Hawk. Mr. Moulton has, for years, owned the Rocky Mountain concentrator, a fair-sized crushing and jigging plant formerly operating on custom ores. This mill occupies the exact site of the first smeltery in the state—the Hill furnace, materials for the construction of which were hauled by ox-teams from St. Joseph, Mo. While this mill has lain idle for several years, these men have been experimenting along hydro-metallurgical lines and they believe they possess a wet process for recovering the precious and the several base metals in Gilpin county ores. The secret process is known to include roasting and lixiviation followed by selective precipitation. Two carloads of machinery have been delivered to be erected on foundations now being laid in the remodeled building.

BUTTE—Nov. 10

In the Districts Tributary to Helena, former Senator W. A. Clark has bought Monte Cristo mine, situated 2 mi. north of Rimini, and work will be begun immediately. Purchase price said to be $100,000. Syndicate which recently acquired "Head" mine on Scratch Gravel has been formally incorporated as Scratch Gravel Gold Mining Co. for $1,000,000. W. E. Cullen, of Spokane, Wash., is president of company. Last month was first month ore was hoisted and profits aggregated $24,000. The Monarch mine near Elliston, has been leased and bonded to a group of Helena mining men. Development work will be started at once. Property lies on north slope of Bison Mountain, 9 mi. south of Elliston, and 6 mi. south of Rimini. Property is developed by shaft and tunnel, where body of commercial galena ore has been opened up. Several carloads of high-grade ore have been shipped and thousands of tons of low-grade ore are on dump awaiting treatment. Property is one of most promising in district. Helena Mining Bureau has leased and bonded Little Wonder mine and stamp mill, at head of Nelson gulch, and work will be commenced as soon as necessary improvements are made.

SALT LAKE CITY—Nov. 11

The Ore Production of Bingham at present is in the neighborhood of 945,000 tons of ore per month. The Utah Copper is producing 27,500 tons of ore daily, and the Utah Consolidated, United States Smelting, Bingham-New Haven, Utah Apex, Bingham Mines, Utah Metal and Tunnel, 2,000 tons more, which with 2,000 tons being mined and milled at the Ohio Copper makes a total daily output of approximately 31,500 tons, or 945,000 a month.

The Strike at the Silver King Coalition mine in Park City ended Nov. 9, when a miners' meeting was held, and it was voted to return to work. Notices had been posted by the company to the effect that the miners would be taken back in their old standing, if they signed the compensation agreement and returned to work before 6 o'clock, Nov. 10. Exception was made of some of the shift bosses who had struck, and a certain number of men deemed agitators. Of the 210 former employees, who applied for work on Nov. 9, 149 were signed up. Some work was done on the night shift Nov. 9, and a full shift was worked Nov. 10. Things at the mine will soon be in normal running order. Up to 6 o'clock on Nov. 10, 230 men, out of the 370 who walked out, had signed the compensation and insurance contracts over which they struck two weeks ago. The strike has been characterized by freedom from violence or other demonstration, and the men have conducted themselves in an orderly manner throughout the time they were on strike.

In the New Zinc Camp, Lakeview mining district on Promontory Point, Box Elder County, there are now eighteen incorporated companies, and about 150 men are employed. The Lakeview Mining Co. declared another dividend of 2¼c. a share Nov. 6. This calls for the distribution of $11,250. In October a similar amount was paid, making $22,500 in two months. In June, July and August seven mills a share was distributed each month. Altogether approximately 7c. a share has been paid on the 500,000 shares, making total dividends of about $35,000. To date shipments have amounted to 67 cars of zinc ore containing 3,149 tons, which averaged 32.75% zinc. The prices received varied from $27 to $55 a ton. This ore at an average price of $40 per ton brought approximately $124,960. In addition to the above, five cars have been shipped by lessees. Three thousand feet of tunnel work has been done; a new compressor was installed and placed in operation Nov. 6, and a new lower tunnel is being started to prove the ore at greater depth. It is reported that an option has been taken on this company's property by the A. S. & R., which is doing development.

FARGO, N. D.—Nov. 13

Dakota Lignite for heating will hereafter be used by all state institutions of North Dakota. In most cases however it is necessary to mix with some bituminous coal, owing to the high moisture content of lignite.

OURAY, COLO.—Nov. 10

The Wanakah Mining Co., operating claims adjoining the American Nettie ground, north of Ouray, and in control of the Ouray smelting works, is planning to conduct extensive explorations and to expand the smelting operations so as to treat custom ore. The control of the company has recently been changed and G. W. Barnhart, of Ouray, formerly manager of the Mountain Top mine, at Telluride, has succeeded John T. Roberts, Jr., in the management of the property. George H. Beebe, of Syracuse, is the new president. The mine is connected with the mill by an aërial cable and the ore is hauled from the mill to the smeltery 2 mi. by railroad. The ore is mostly heavy iron sulphide with from 2 to 8% copper and some precious metals. Some of the ore is amenable to milling but owing to the large loss of copper in the mill, practically all of the output now goes to the smeltery. The smeltery, which was improved and enlarged last summer has a capacity of 250 tons a day, but this has been reduced to 150 tons by a fire-brick partition in the furnace chamber. Semi-pyritic smelting is practiced with a consumption of about 10% coke. A two-unit Greenwalt sintering equipment is installed. The matte is shipped to Garfield, Utah. The company has heretofore largely depended upon its own mine for smelting ore but is now planning to treat custom ore, particularly siliceous ores, a policy which has already had its effect of stimulating operations in the district. The Wanakah mine in the last four years has produced nearly a million dollars gross.

The American Nettle Property now belongs to the American Gold Mining Co., of St. Louis, Mo., W. C. Wisberg president. The company drove a tunnel to the Wanakah ore horizon and several other operations are under way to explore for deposits of the Wanakah type in the sedimentary cliffs north and east of Ouray. The Two Kids property has opened up an orebody and is building a small mill. This operation is financed at Delta, Colorado. On Black Silver Mountain to the north of the American Nettie, limited operations are under way on the Black Girl, the Scotsman and the Cutler Creek properties.

The Results of the Development at Wanakah have aroused interest in the possibilities of the sedimentary areas in the vicinity of Ouray, which occur extensively north and west of the town and which are cut by numerous dikes. The important mineralization so far has been found on the east side of the cañon only and its extent is still to be determined.

In Poughkeepsie Gulch, Uncompagre Cañon, the Old Lout mine, now owned by the Onetal company, 10 Wall St., New York, is being equipped with an electric compressor and drills for extensive development. This vein has been opened on the surface for about 600 ft. in depth and has a record of about $800,000 production of rich bismuth-silver ore. The tunnel cuts the vein at about 1,000 ft. in depth and a drift on the vein has opened three oreshoots, showing sulphide ore, with copper, lead, zinc and silver. The company has a lease on the Mickey Breene mill and is to introduce flotation. It is expected that some shipping ore will be extracted this winter. Frank M. Jackson is in charge. This property was last worked by an English company in the early nineties.

The Maid of the Mist adjoins the Old Lout on the north and will probably be developed from the Lout tunnel. The Poughkeepsie mine, at the head of the Gulch, has suspended developments but will resume in the spring. The Benock, on the north extension of the Lout is being operated on a lease by John T. Roberts, Jr.

No Work Has Been Done during the past season on the San Juan Chief, the Huff or the North Star properties, all of which lie east of the Lout. The Ben Butler is under option to W. M. Waybright and some work has been done on it. The ore in the Ben Butler is zinc with gold. W. J. Rattles, of Cleveland, Ohio, is in charge of work on the Vermilion mine, about half a mile south of the Ben Butler. The Columbus tunnel, in this vicinity, is being extended to cut the Columbus vein. On Red Mountain the National Belle is under lease to Messrs Roberts, Wood and Forest, of Ouray, and is shipping, regularly, high-grade copper ore. When the mine was opened recently it was found that the rails, tools and nails of the old equipment were entirely replaced by copper.

WALLACE, IDAHO—Nov. 10

American Institute of Mining Engineers—The fifth annual meeting of the Columbia Section will be held at Wallace, Idaho, Nov. 19-20. A special train leaving Spokane at 8:30 a.m. will arrive in Wallace at 12:50 p.m. At 3:00 a technical session will be held in the public library, at which D. W. Buckby will present a paper on "Progress in Ore Dressing" and J. E. Chapman one on "Mine Accounting." At the evening session W. E. Henry will discuss "Zinc Smelting and Smelter Rates." The following day will be given over to a trip to the Interstate-Callahan, Tamarack and Success mines on Ninemile; a business session and banquet will be held in the evening. A special invitation has been extended to members of the Montana section of the Institute.

PHILADELPHIA—Nov. 15

Pennsylvania State College—The new mining building of the School of Mines was dedicated on Nov. 5. Dr. H. M. Chance, of Philadelphia, the speaker of the day, took as his subject "The Conservation of Mineral Resources." There was a large gathering of people, among whom were many prominent mining men from both the bituminous and anthracite fields The museum of the school, one of the best in the United States, is being installed in the new quarters, which together with the added facilities for classroom and laboratory work, will contribute materially to the increased usefulness of the school. The School of Mines was established in 1884 and has graduated a large number of men now prominent in mining in Pennsylvania as well as in many other states.

IRONWOOD, MICH.—Nov. 13

Shipments from the Gogebic Range for 1915 will exceed 5,000,000 tons. To Oct. 25, the Chicago & Northwestern Ry. Co. had hauled 3,600,000 tons of Gogebic ore to the Ashland docks. The most the company has ever handled in a single year was 3,760,000. The Soo line will take out about 1,000,000 tons this year.

HOUGHTON, MICH.—Nov. 13

A Million a Month in Wages Was the Slogan when the copper country of Michigan hoped, some day, to reach total monthly pay roll of a million. At the present time that slogan is out of date. A million and a half a month is more nearly correct. Each Saturday pay day the mining corporations distribute to employees at least $700,000. This is for half a month's work. One mining corporation alone pays out over $230,000 in cash.

BRAINERD, MINN.—Nov. 11

Indian Commissioner Sells ordered closed on Nov. 1 all saloons in Chisholm, Hibbing, Taconite and several smaller Mesabi Range towns. Entire Cuyuna Range has been "dry" for some time, and the commissioner's action now makes large part of Mesabi Range dry as a desert. Mine operators in general favor the drys.

TWO HARBORS, MINN.—Nov. 10

Duluth & Iron Range Ry., announces according to W. A. Clark, chief engineer, that it will expend $1,635,000 for dockage facilities at Two Harbors. A steel and concrete dock, costing $1,500,000, will be built, and Dock No. 6 will be remodeled. The new, or No. 2 Dock, will be 80 ft. high, with 228 pockets.

At Two Harbors Dock, 10,098 carloads came from the Biwabik District in October, being a nominal decrease from September. The Biwabik and Bangor mines are the leading shippers, with 1,286 and 1,416 cars respectively to their credit. The total ore tonnage for October via Duluth-Superior and Two Harbors docks was 1,800,000 tons in excess of October, 1914, all roads participating in the increase except the Great Northern which had a decrease of 150,000 tons. At Ashland, Wis., all iron ore shipping records have been broken, and indications point to still greater figures for next season. To Nov. 1 the C. & N. W., and Soo Line docks had a combined tonnage of 4,754,397 with several weeks yet to operate, while the best previous season (1912) totaled but 4,797,101 tons.

VICTORIA, B. C.—Nov. 8

The Leona, carrying a heavy cargo of ore from the Britannia mines on Howe Sound to the Tacoma smeltery, turned turtle and foundered due to the shifting of her cargo during a heavy gale when nearing Active Pass on the night of Oct. 31. Seven out of the crew of 14 were drowned.

TORONTO—Nov. 13

The First Run of Manganese Steel ever manufactured in Canada was turned out on Nov. 6 by the Wabi Iron Works, of New Liskeard in Northern Ontario. It is produced by electric process in a furnace of the Heroult type having a capacity of 5 tons per day.

Part of the famous "silver sidewalk" that contributed to so much of the excitement in the early days of Cobalt has been purchased by the Department of Mines and is being removed. The Department does not wish to allow such a remarkable specimen to be lost, and as there is little probability of such a showing ever again being discovered, it will be kept for the museum.

The Mining News

ALASKA

ALASKA GOLD (Juneau)—In October treated 154,500 tons of ore, compared with 132,000 tons in September. Total cost per ton is now under 60c., and tailings are running under 19c. Plant is regularly treating 6,000 tons per day, which is approximate limit of present power capacity at Salmon Creek. New power plant at Annex Creek should be in commission in December, when operations will be brought up to 10,000 tons capacity.

ARIZONA

Gila County

KEYSTONE COPPER (Miami)—At special meeting of stockholdders it was voted to dissolve company and distribute assets to stockholders. Meeeting of directors to be held immediately to arrange distributon.

ARIZONA ASBESTOS ASSOCIATION (Globe)—Has opened up a large deposit of chrysotile asbestos of the finest quality at Ash Creek Cañon. Output is sold some time in advance and is being used by most exacting manufacturers of asbestos textiles.

INSPIRATION CONSOLIDATED (Miami)—Is operating 9 out of 18 sections of mill and is handling 7,000 tons of ore daily; extraction of 82% being secured on average of all ore handled; recovery on sulphide ore alone is about 93%. During October produced about 4,000,000 lb. of copper. November output expected to be greater.

Greenlee County

ARIZONA COPPER (Clifton)—Company's Clifton concentrators Nos. 2 and 3, instead of No. 4 as reported, together with 300 ft. of big ore bins and conveyor belt leading from the mill to the leaching plant, burned Nov. 5. Fire started about 8 o'clock and lasted greater part of night, and but for work of fire fighters, company's store, leaching plant and other property would have been destroyed. Deputies and pickets state that conflagration started near top of old mill, and Sheriff Cash, in whose care property has been since managers left district, claims it was due to defective wiring. Men who are familiar with plant, however, are positive that fire could not have been caused by loose wires in the locality where it originated. Property that burned was not being used when strike was called, Sept. 11, but was being extensively remodeled, and new and modern machinery was being installed. The loss is estimated at $100,000 to $150,000. Destruction of property would not preclude an early resumption of work should managers and strikers come to an agreement.

Mohave County

LEVIATHAN MINES (Oatman)—Recently encountered ledge of ore in its mines averaging more than 50% copper.

UNITED STATES SMELTING (Kingman)—Has taken option on Antelope and Democrat claims, situated in Wallapai Mountains, from their owners, W. H. Murphy and W. F. Dunlap.

ARIZONA TELLURIUM CO. (Kingman)—Is preparing to install hoist, compressor and other machinery at its mines in Wallapai Mountains, 16 miles east of Kingman. The ore runs high in gold and silver.

COLORADO RIVER PLACERS (Oatman)—D. P. Mitchell and associates are negotiating with syndicate of Eastern men for sale of about 2,000 acres of placer ground, situated along lower course of the Colorado River. Mineral bearing bars are 35 to 45 ft. deep.

Pinal County

MAGMA COPPER (Superior)—For quarter ended Sept. 30 company produced 1,973,960 lb. copper, at an average cost of 5.72c. per lb., compared with 1,302,199 lb. at 6.19c. per lb. for preceding quarter. Operating profit for third quarter was $238,490, compared with $186,057 for preceding quarter.

Yavapai County

TELSORI MINING (Cherry Creek)—Company is erecting new stamp mill at its Nelson mine. Has large amount of ore blocked out.

DEVELOPMENT CO. OF AMERICA (Congress)—Is reported to be negotiating for sale of its Congress gold mine, including old tailings dump, which contains about 1,200,000 tons of ore, valued at $2 per ton.

PORTLAND-ARIZONA (Copper Basin)—O. W. Bickenstaff and associates have sold their group of 28 Portland-Arizona copper claims to D. M. Looey, of St. Louis, Mo., and associates. The new owners will conduct extensive development operations.

CALIFORNIA

Amador County

EAST EUREKA (Sutter Creek)—Cleaning out and repairing north shaft, which was caved about 20 years ago. Recent development has been through south shaft, which proved that greater possibilities of developing pay orebodies lie to north.

Calaveras County

UTICA (Angels Camp)—Repairs in progress at Stickle mill and Cross shaft, preparatory to resuming operation when water supply is sufficient.

CALAVERAS COPPER (Copperopolis)—Forty men reported to have been laid off because of lack of bin capacity for ore extracted, which is in excess of mill capacity. Reported that additional concentrating installation is contemplated.

Eldorado County

WAGNER (Lotus)—High-grade ore reported disclosed in 37-ft. drift from 54-ft. shaft. New machinery will be installed before proceeding with further development. Ore contains large percentage of copper and some gold.

COX & MASSA (Placerville)—Work started in 600-ft. tunnel. Reported that rich gravel has been disclosed. Large body of deep gravel opened on Coffin & Reed property adjoining.

STILLWAGON (Placerville)—Los Angeles men have leased this property at forks of Cosumnes River, 2 mi. south of Caldo R.R. Present operators are extending 800-ft. tunnel about 100 ft. in belief that oreshoot will be tapped at vertical depth of 500 ft. Mine is equipped with stamp mill and electric generating plant, both operated by water power.

Inyo County

WILSHIRE-BISHOP CREEK (Bishop)—Arthur Joslin was killed Oct. 22 by falling of an ore car into shaft, car striking cage in which Joslin and three other men had descended.

CERRO GORDO (Keeler)—Contract reported signed by F. J. Hambley and A. L. Dornberger on behalf of company and Southern Sierras Power Co., for electric current for mine for lighting, drilling, hoisting and all other operations.

Kern County

HOPE (Randsburg)—Philadelphia men reported to be negotiating for control. Deepening of 250-ft. shaft to 500 ft. contemplated. Large shoot of ore disclosed at 250 ft. Recent shipment of ore averaging $80 per ton.

Merced County

SAN JOAQUIN LIGHT AND POWER (Merced Falls)—Work begun on construction of new $65,000 plant for generating electric power.

Modoc County

SEITZ (Cedarville)—Copper claims on Neasham Mountain have been bonded to T. G. Elgie. Development work has disclosed good copper-bearing ore in 5-ft. ledge.

Nevada County

SPENCEVILLE MINERAL (Spenceville)—All buildings and surface plant destroyed by fire night of Oct. 30. Suspected incendiary origin. Copper revival had induced preparations for operating on much more extensive scale.

BLACK BEAR (Rough and Ready)—Directors have retained William Buchholz as managing director; William Gans is superintendent. Company was recently reorganized and sufficiently financed to deepen shaft and install machinery for development work.

MOHAWK (Graniteville)—Antimony ore reported to be found in sufficient quantity and quality to justify reopening of this mine on Moores Flat, owned by William McLean of Graniteville and Charles Scheunert of Sacramento. Old tunnel is being cleaned out and placed in condition, and driving on the vein will be resumed.

WILLOW VALLEY (Nevada City)—New electric pump with capacity of 500 gal. per min. is being installed. This will permit development to depth of 1,200 ft. Montana shaft now down to 830 ft. Both properties have records as producers and it is believed that they will again be put in producing class.

Placer County

GREEN EMIGRANT (Forest Hill)—R. A. Nicol has bonded this mine on Bald Hill to E. W. Drumond and Joe Delmue. Reopening and development will begin immediately.

Sierra County

ANDY FITZ (Alleghany)—Permit issued by Commissioner of Corporations to sell 75,000 shares stock at 25c. to finance exploration and development of quartz ledge.

KLONDIKE (Sierra City)—Machinery and winter supplies being taken in for continuing tunnel to tap gravel channel, expected within 100 ft. more. W. W. Tiner in charge.

Siskiyou County

MANGANESE claims have been located near Black Bear mine in Salmon River district. Ore said to contain high percentage of manganese. Surface crosscut has been run 144 ft. Ledge is almost vertical; walls are porphyry and diorite. Reported that New York men have taken a bond and will develop property.

SISKIYOU MINING (Etna)—The 15-mi. flume is being lengthened 1½ mi. to cover Muck-a-Muck flats which embrace about 400 acres of gravel. Property is owned by Dr. Harback and Mr. Gardner of New York. Mr. Payne is superintendent.

Trinity County

TRINITY ASBESTOS (Cinnabar)—Closed down for winter. Work will be resumed as soon as weather will permit in the spring.

BONANZA KING (Trinity Center)—Has abandoned old 3-mi. tramway, and has erected bunk houses, cook house and mill at mine, and will operate now during winter as well as summer.

CRAIG (Dedrick)—R. W. Hamilton, of Weaverville, and H. C. Stofer, of Dedrick, have taken a five-year lease on this property owned by Globe Consolidated Mining Co. Development work will be carried on throughout winter.

GLOBE CONSOLIDATED LEASE (Dedrick)—Began operating the Globe Consolidated Co.'s mill and properties at Dedrick, Oct. 1. About 40 men are at work developing orebodies on Bailey and also on two levels of Globe. Archie Burnett is new manager.

BELLI (Coffee Creek)—Property shut down for the winter after successful and steady run since July 4. Ore put through mill averaged $30 per ton. New wagon bridge is being constructed across Trinity River while water is low.

BONANZA KING (Weaverville)—Large orebody reported in lower tunnel driven 1,500 ft. into hill. Milling plant being moved to mouth of tunnel which will save transportation of ore over a mile of tramway. Tramway is in heavy snow belt and is difficult to keep in order.

Tuolumne County

REPUBLICAN (Sonora)—Purchase bond covering five mining claims and 20-stamp mill delivered to F. W. Page, manager Royal Consolidated mine at Hodson, Calaveras County. Mr. Page represented Eastern men in this deal. Shaft is 700 ft. deep. Price said to be $65,000.

COLORADO

Gilpin County

EAST NOTAWAY (Russell Gulch)—In the "Journal" of Oct. 23 was published an item in this column stating that the mine after being closed for a year by litigation, had been finally secured by opposing litigant, Colomo Mining Co., and was to be reopened. We have various communications from parties to the two sides of the litigation relative to the item and to each other. We hold our honorable correspondents in equal esteem, and considering our distance from the clouded issue, we are disinclined to judge the evidence.

San Miguel County

TOMBOY (Telluride)—At recent meeting in London it was announced that Sidney White Cloud group of claims, situated to north of Bushwhacker claim, and carrying extension of Montana vein, has been acquired for consideration of $75,000, to be paid in cash instalments before June 15, 1916. During October mill ran 29 days; crushed 13,000 tons of ore. Bullion and concentrates shipped totaled $88,400; expenses, $60,600; operating profit, $27,800.

IDAHO

Shoshone County

INTERSTATE-CALLAHAN (Wallace)—Shipments during October were heaviest in history of mine, totaling 6,500 tons of crude ore and concentrate.

AMERICAN-COMMANDER (Wallace)—This company is building blacksmith shop at tunnel portal and otherwise preparing for winter work. Has 400 ft. of crosscut yet to drive to reach vein.

ALAMEDA (Wallace)—Is suing Success, alleging illegal extraction of ore to value of $30,000 from its ground; Success admits extraction of ore but claims title to ore under apex law. Rumored that properties will be consolidated and action dismissed.

CASTLE ROCK (Wallace)—Idaho-Nevada Exploration Co., has resumed work on Castle Rock situated on Placer Creek. Operations delayed by lack of water for power. Crosscut from 200-ft. level of shaft has penetrated vein 20 ft.; 12 ft. of ore assaying 4 to 5% copper reported; small stringer assaying 3% zinc and 3% lead on footwall.

BERNICE (Kellogg)—Capital stock of this company increased from 200,000 to 1,500,000; 250,000 shares of new stock to be transferred to Wardner Mining and Milling Co., in exchange for its holdings. Bernice company owns 8 claims east of Caledonia, on which two veins have been located; will drive crosscut to cut veins at intersection.

MARSH (Burke)—Reported strike of 18 in. of shipping ore in crosscut from 900 level. As soon as oreshoot is explored sufficiently to prove persistence, sinking will be continued to 1,200 level. Large pump ordered last summer will be installed temporarily at 900 level but will be removed later to 1,200. Remodeling of mill on Ninemile completed, increasing capacity from 150 to 225 tons daily.

GALENA GROUP (Wallace)—Cœur d'Alene M. & S. Co., plans to develop Galena group, lying west of Success on Ninemile. Two tunnels previously run and winze sunk 60 ft. from upper; good showing of carbonate ore, but work was suspended on account of water. Crosscut tunnel driven 900 ft. tapped vein at depth of 500 ft.; 400 ft. of driving on vein necessary to get under ore in shaft.

PORTLAND (Sunset)—D. L. McGrath, manager for the Ray-Jefferson company, has taken option on Portland claims on Sunset Peak, situated between Sunset Group, owned by W. A. Clark, of Montana, and Tuscumbia group. Claims have been idle since death of George B. Markle, organizer of Portland company. Two tunnels each about 500 ft. long have good showing but maximum depth obtained was only 100 ft. Owing to elevation of mine and heavy snowfall development will not be started till spring.

MICHIGAN

Copper

HOUGHTON (Houghton)—Sinking continues in good commercial rock.

NEW ARCADIAN (Houghton)—Third test of copper rock satisfactory, 1,500 tons being handled.

WOLVERINE (Kearsarge)—Rock running close to 18 lbs. to ton. Rock keeps two stamp heads running to capacity.

BALTIC (Painesdale)—Richest copper-bearing ground yet located in this mine is now proven to extend from 14th to 22nd level. Increase in rock tonnage expected soon.

COPPER RANGE CONS. (Painesville)—Announcement made of 10% bonus for November and December for 3,000 or more men working at mines and mills of Copper Range company.

SOUTH LAKE (Houghton)—New steel shaft-rockhouse will be built within four months. Foundations now being laid. Both 3 and 1 lodes in commercial ore. Expected that 10,000 shares new stock will be subscribed by present share owners.

BALTIC (Painesdale)—Transmission line, from Redridge mill plant is under construction to mine over right of way of Atlantic railway, to utilize excess turbine power at Baltic mine, a subsidiary of Copper Range. W. A. Rankin, chief electrical engineer of Copper Range is in charge.

CHEROKEE (Houghton)—Operations suspended for winter. Work economically conducted under direction of W. A. Hodgson and results in three exploration pits showed good prospects. Small exploration shafts will be put down in most promising pits next summer.

VICTORIA (Victoria)—Conditions continue to improve. It will be several months before new hoist is in running order and new shaft ready for work. That will mean larger tonnage and closer selection, so that 13 lbs. per ton can be maintained. This can be operated profitably by Victoria even if output is sold on 13c. basis, because of low power costs.

WHITE PINE (Ontonagan)—Railway connection now is established and within week regular train service will be in operation. St. Paul end of line was finished week ago and connection made with portion built by Smith, Byers & Sparks on contract for Calumet & Hecla. This will mean enormous savings for White Pine. At present 90 men are employed cutting wood for fuel for the boilers. There is large accumulation of mineral on hand waiting to go to smelter at Hubbell.

Iron

DOBER (Iron River)—Oliver Iron Mining Co. is to sink another shaft here. Work will be started soon after Jan. 1.

CLEVELAND-CLIFFS IRON (Ishpeming)—Has only about 45,000 tons more to ship this season. L. S. & I. road expects to be through handling iron ore by Nov. 20.

BUCKEYE (Commonwealth)—This property has been abandoned by Oglebay-Norton & Co. Sulphur content of ore is too high. Is one of oldest mines on Menominee Range.

OLIVER IRON MINING (Ironwood)—Night shifts have been added at mines that have not been working with two forces. Pabst has had two crews for some time. About 400 more men will be given employment.

MASS (Negaunee)—A Halby loading machine is being tried out underground. It is working successfully but has not been in operation long enough to give data. The Lake Shore Engine Works is building 10 of the machines. Most of them will be shipped West. The Copper Queen Mining Co. has ordered one shipped to Bisbee, Ariz.

MINNESOTA

Duluth

MINNESOTA IRON DEVELOPMENT (Duluth)—Has obtained fee to 8,697 acres of mineral lands in St. Louis, Crow Wing and Aitkin Counties. Options are held on 591 acres additional. Properties are located on Mesabi, Vermilion and Cuyuna Ranges. Exploring is to be started immediately. E. J. W. Donahue, formerly of Cuyuna-Mille Lacs and Cuyuna-Duluth companies, is one of directors.

Cuyuna Range

CUYUNA-MILLE LACS (Ironton)—Shipping 10 cars daily of its manganiferous product.

Mesabi Range

TIOGA (Chisholm)—Shaft now down 103 ft., and working in wet ground.

DEAN (Buhl)—All shipping has ceased and mine was shut down Nov. 6.

MYERS (Chisholm)—All ore in stock is to be shipped this fall. This will be last of Oliver piles to be moved.

TIOGA (Chisholm)—Excavating is completed in engine house for engine bed. Work on new change house is progressing satisfactorily.

HAWKINS (Nashwauk)—Mine was closed down Nov. 4. No more ore will be shipped this season. Averaged about 70 cars a day during last two months.

EUCLID (Chisholm)—M. A. Hanna Co. is to ship ore in stock here. Mine is near lake and could not be kept open. Water kept coming in until workings flooded.

ALEXANDRIA (Chisholm)—All of dwelling houses for men have been completed. Drifting is going on from bottom of main shaft. Timber shaft is going down steadily.

OLIVER IRON MINING (Eveleth)—Stated that Fayal and Genoa mines will be operated all winter. About 650 men will be kept employed at two properties. Company has shipped 1,100,000 tons from Eveleth district this season.

Vermilion Range

CHANDLER (Ely)—Both the North and South Chandler mines have raised miners' pay 30c. a day. They have heretofore paid $2.10 to $2.40, and raise is to meet wages of $2.40 to $2.80 paid by the Steel Corporation mines in district. It has been many years since an increase in wages has been made in fall of year.

MONTANA

MONTANA-CANADIAN OIL (Sweet Grass)—Fine flow of gas obtained Nov. 10 in company's well. Is taken as sure indication of presence of oil. Gas will be used from now on for firing boilers that supply power for drilling, thus saving $1,000 a month in operating expenses. Company's well is now down 1,500 ft. Nearest adjoining well struck oil at 1,735 ft.

Fergus County

BARNES KING DEVELOPMENT (Kendall)—During October 4,128 tons of ore, averaging $8.84 a ton, were mined and milled at North Moccasin mine. Total includes 893 tons of ore requiring roasting which averaged $1.42 a ton. Bullion estimated at $33,000. At Piegan-Gloster property near Marysville, 2,437 tons of ore were mined and milled averaging $7.51 a ton. Bullion estimated at $11,000.

Silver Bow County

ALICE (Butte)—No offers having been made at public sale held Nov. 10 in front of federal building at Butte, under terms of court's decree property reverts to Anaconda.

EAST BUTTE (Butte)—Net earnings of company for quarter ended Sept. 30 were $423,000. September net was $170,000, largest for any month on record, but exceeding July figure by only $6,000.

NORTH BUTTE (Butte)—According to report for quarter ended Sept. 30, company shipped 115,796 wet tons of ore and 27½ wet tons of precipitates. It treated 113,002 dry tons of ore and 19.6 dry tons of precipitates. Of ore, 12% was first-class and 88% second-class. Ore and precipitates produced 5,672,890 lb. of copper, 265,855 oz. of silver and 305 oz. of gold.

NEVADA

Esmeralda County

ATLANTA MINES (Goldfield)—Stoping has been started on 1,580 and 1,620 levels and shipments are to be resumed at once. Expect to maintain grade of $35 per ton.

GOLDFIELD CONSOLIDATED (Goldfield)—Preliminary estimate for October shows production of 36,500 tons of gross value of $256,000; with profit of $101,000. Red Top claim and adjoining north-end ground has again become large producer on company account from territory largely given over to leasers for last two years.

Humboldt County

SEVEN TROUGHS COALITION (Seven Troughs)—Produced $60,000 in October; banner month in history of mine. The next nearest approach was December, 1914. Between 1,200 and 1,300 levels, shoot 1 to 3 ft. wide and bringing returns of $300 to $1,000 a ton discovered.

ROCHESTER MINES (Rochester)—By reason of delays in transportation of ores necessitating closing down of mill for several days, output for October was only $40,000. With discovery of rich orebodies of unusual extent in deep levels and improvement of hauling facilities on Nevada Short Line railroad, there is every reason to anticipate production of $2,000 per day for November.

Nye County

TONOPAH ORE PRODUCTION for week ended Nov. 6 amounted to 10,343 tons valued at $212,134 compared with 9,891 tons week previous. Producers were: Tonopah Belmont, 2,990 tons; Tonopah Mining, 3,230; Tonopah Extension, 1,850; West End, 904; Jim Butler, 1,100; Halifax, 50; and miscellaneous leasers, 219 tons.

TONOPAH EXTENSION (Tonopah)—Installation of 20-drill compressor at No. 2 shaft about completed. Additional equipment being installed at mill expected to increase capacity materially. September profits amounted to $52,000. Developments during October showed steady improvement in general mine conditions, with mill products for latter half of month valued at about $80,000.

Storey County

ANDES (Virginia)—Saved 14 cars of ore from stope above 170 level.

OPHIR (Virginia)—Saved 343 cars of ore from north drift on 250 level, Central tunnel; milled 280 tons.

MEXICAN (Virginia)—Exploration work continued on 2,500 and 2,700 level. Mill crushed 252 tons of custom ore, average assay value $18.56 per ton.

CROWN POINT-BELCHER (Gold Hill)—Reopening north drift 1,600 level, leading to stopes. Water held 65 ft. below 1,600 level. Mill rock taken from 1,300 and 1,400 levels. Mill received 976 tons dump rock and shipped one bar bullion.

UNION CON. (Virginia)—Extracted 59 tons of ore averaging $24.60 per ton from No. 1 stope, 2,500 level; 181 cars sampling $13.72 per ton from No. 3 stope. West crosscut in No. 1 raise in low-grade ore; selected samples north side assayed $24.05 per ton, and from top $45.16 per ton.

SIERRA NEVADA (Virginia)—Northwest drift on 2,500 level advanced to 20-ft. point; face in ore averaging $31 per ton; saved 40 cars of ore averaging $33 per ton. Jointly with Union, raise to 2,450-ft. level continued and into quartz of low assay value.

NEW MEXICO

Grant County

DARK THUNDER MOUNTAIN (Twin Peaks)—Paul Crowley, of Duncan, Ariz., claims to have discovered enormous deposit of low-grade zinc ore on Dark Thunder Mountain.

CARLISLE GROUP (Silver City)—Announced by George Utter that he has sold Carlisle group to an Eastern syndicate for $300,000. Purchasers are represented here by W. B. Duvall, who will soon place order for mill, machinery and other equipment. Construction of branch railroad to mines is contemplated.

Lincoln County

RITA MINING (White Oaks)—Rita Mining Co. is negotiating for sale of its rich mineral holdings to W. M. McDonald, of El Paso, and associates. Its group of claims embraces 60 acres.

MINING TUNGSTEN ORES (White Oaks)—Richard Wightman and syndicate of New York men have just closed deal for purchase of Old Abe, North and South Homestake and Wilson mines from John Y. Hewitt and associates. New owners have began mining operations on large scale and it is their object to develop tungsten ores which are known to exist in North and South Homestake mines. Plans being made for modern mill and cyanide plant for treating gold ores.

SOUTH DAKOTA

Custer County

OLD MIKE (Custer)—J. W. McBride has taken over this mica property and has commenced development. A shaft is being sunk and hoisting apparatus and compressor being added

UTAH

Box Elder County

WEST CENTURY (Park Valley)—Lease has been taken on this property by A. Allred. Development consists of tunnel 500 ft. long. Low-grade gold ore has been cut. It is expected to mill some of this at small mill on adjoining property.

Juab County

TINTIC ORE PRODUCTION for October amounted to 643 carloads, estimated at 32,150 tons valued at $800,000, compared with 506 cars in September, 648 in August, 817 in July and 2,790 for the first half of 1915. There were 25 shippers as follows: Chief Consolidated, 126 cars; Iron Blossom, 115; Centennial-Eureka, 88; Mammoth, 81; Eagle & Blue Bell, 72; Gemini, 35; Grand Central, 27; Yankee, 18; Gold Chain, 14; May Day, 13; Dragon Consolidated, 12; Beck Tunnel, 8; Lower Mammoth, 7; Victoria, 5; Colorado, 4; Uncle Sam, 3; Utah Miner Co., 3; Bullion Beck, 3; Carisa Lease, 2; Eureka Hill, 1; Godiva, 1; Ridge & Valley, 1; Sioux mill dump, 1; Minnie Moore lease, 1; Clift lease, 1 car.

TINTIC MILLING (Silver City)—Steel work is being erected at leaching section of this mill.

BECK TUNNEL (Eureka)—This company is developing ground on the 1,100. Leasers are working in various parts of the mine as usual.

IRON BLOSSOM (Silver City)—Preparations are being made for stoping ore opened on the 900 level, from the winze below the 600. The ore carries up to 8 and 12% copper.

IRON BLOSSOM (Silver City)—Copper ore has been opened on 900 level of No. 3 workings. This is reached by winze from 600, reported to have passed through 14 ft. of ore.

CHIEF CONSOLIDATED (Eureka)—Shipments for the first 10 months of 1915 amounted to 831 cars or about 41,500 tons. Arrangements for electrifying the compressor will soon be completed.

RIDGE & VALLEY (Eureka)—Value of ore mined on 1650 is increasing, returns now being over $1,200 per car, instead of $1,000 as heretofore. Principal contents are lead and silver.

EAGLE & BLUE BELL (Eureka)—Work has been started on power line between substation, owned jointly with Chief Consolidated, and new Eagle & Blue Bell 300-hp. hoist. Work is being done by Utah Power and Light Co.

YANKEE CONSOLIDATED (Eureka)—Connections have been completed between raise and winze, which allows ore to be sent out from new strike. Prospecting is being done on east side of property in search of Beck Tunnel ore channel.

Salt Lake County

A FOOT OF SNOW FELL at Alta Nov. 10; 8 in. fell in south fork of Big Cottonwood, and 2 ft. at Brighton. This will not interfere materially with ore hauling.

MICHIGAN-UTAH (Alta)—Nine bids have been received for proposed extension work in this company's lower tunnel. These varied from $9 to $13 a foot.

EMMA (Alta)—Men were started to clean out tunnels Nov. 6, preparatory to beginning work at this property. A. O. Jacobson and associates have made arrangements to operate.

SOUTH HECLA (Alta)—Shipments of 40 tons of ore daily are being maintained from the Wedge workings. Development is being done on 200 level, where vein reaches 25 ft. in width. This ore has been opened up for 185 ft. Lessees on Kate Hayes fissure have recently shipped 15 tons.

EMMA COPPER (Alta)—Development is in progress at this property, adjoining the old Emma. Several contracts for work have been let recently, and operations will be continued during winter. Drift from north crosscut is in mineralized ground, on contact of white and gray limestone.

OHIO COPPER (Bingham)—An experimental flotation plant using Field process is to be tried at this company's mill at Lark. Capacity will be 25 tons per day. Experimental work will probably be done on Ohio Copper tailings, as well as on low-grade ore at present being treated.

Summit County

PARK CITY ORE PRODUCTION for October amounted to 9,762 tons, valued at $390,000 compared to 8,000 tons in September. The producers were: Silver King Coalition, 2,742 tons; Daly-Judge, 2,724; Silver King Consolidated, 1,687; Daly West, 1,074; D. W. Quincy, 35; Daly, 120; Big Four Exploration, 1,000; miscellaneous, 380 tons.

CANADA

Ontario

CANADIAN COPPER (Sudbury)—In October sank new main shaft 165 ft.; shaft is 30x10 ft. in clear.

BRUCE MINES (Sault Ste. Marie)—Have been purchased by Mond Nickel Co. Ore, high in silica, carries from 3 to 4% of copper.

PLENAURUM (Porcupine)—This mine shaft, 200 ft. deep, is being pumped out for sampling on behalf of La Rose which may purchase property.

DOME (Porcupine)—Bullion production during October was highest on record, being $150,500, from 28,750 tons of ore; average $5.24 per ton.

CHENEY COPPER (Sault Ste. Marie)—Is under option to the Timmins-McMartin syndicate. Tenders have been asked for diamond drilling but no contract has as yet been let.

TECK HUGHES (Kirkland Lake)—Foundation for cyanide mill completed. Work on power plant delayed pending decision as to whether it will be possible to obtain electric power.

MINING CORPORATION OF CANADA (Cobalt)—This company which controls Cobalt Townsite, City of Cobalt and Cobalt Lake mines, has discharged all Austrians and Germans in its employ. Order, which came from head office in England, affects about 50 men.

The Market Report

Metal Markets

NEW YORK—Nov. 17

All of the principal metal markets experienced sharp advances during the last week which were scored in the transaction of large volumes of business. In copper especially the week was rather spectacular.

Copper, Tin, Lead and Zinc

Copper—On Nov. 11 the market had become well established at 18¼c., regular terms, for domestic deliveries, especially prompt deliveries, but forward business was taken at small concessions, as was also some foreign busines when figured out to the cash equivalent, f.o.b., New York. The volume of business continued to swell, and increased day by day, the price rising with it. On Nov. 15 the advance began to be rather violent. At the opening of that day copper was sold at about 18.45c., regular terms. By the end of the day, 18¾c. was realized in some cases, although the market did not become firmly established at that figure. On Nov. 16, business was done at 18⅝c., regular terms, and even a shade lower, early in the day, but later sales of million-pound lots were made at 19c. It was expected that there would be a rush of buying on Wednesday, but instead thereof the market became rather quiet, with the price firm at 19c. regular terms, equivalent to 18.75@18.80c. cash, New York.

The aggregate of business transacted during the week was very large, the estimates in several quarters agreeing upon something like 50 to 70 million pounds. Sales to domestic consumers predominated and it was especially noteworthy that some very large business was done with the wire drawers.

Certain sellers of copper are now adopting the policy of doing their business with France only in terms of dollars per ton.

The strike at the Nichols refinery was settled on Nov. 16.

Shipments from Baltimore for the week included 7,847,765 lb. copper to France.

Copper Sheets, base price is 23½c. per lb. for hot rolled and 24½c. for cold rolled, with usual extras. Copper wire is 19@19½c. per lb., carload lots at mill.

Copper Exports from the United States week ended Oct. 30 are reported by the Department of Commerce at 13,657,586 lb. The larger items were 5,551,235 lb. to France, 2,930,833 lb. to Russia; 1,996,644 lb. to Sweden, 1,301,411 lb. to England; 1,121,329 lb. to Italy. Imports for the week were 8,498,268 lb. metal and 824,444 lb. in ore and matte; 9,322,712 lb. in all. The chief imports were from Peru, Canada and Chile.

Tin—In this market there was a sharp advance, caused by an urgent demand and the shortage of supply for near-by deliveries. Rumors respecting the Suez Canal also played a part. When it was learned that the canal was open and had not been closed at all, the market receded from its highest point.

Tin production of Federated Malay States nine months ended Sept. 30 is reported at 36,692 long tons in 1914, and 34,840 tons in 1915; decrease, 1,852 tons.

Corrected statement of tin exports from the Straits eight months ended Aug. 31: United States, 19,313; Great Britain, 18,234; other Europe, 6,651; China, 58; India, 862; total, 45,118 long tons, an increase of 1,457 tons over last year.

Lead—Following the advance to 5.15c., New York, independent producers tried to see if they could get a little more and found that they could. The demand for lead was ,indeed, so good, and the transactions so large, that the A. S. & R. Co. felt itself warranted in advancing the price to 5.25c. on Nov. 15. The aggregate of business transacted during the week was very large.

The Chinese Lead Markets are reported badly demoralized by lack of supplies. This has resulted from the order of the Australian Government prohibiting lead exports.

Spelter—A pretty good volume of business was transacted up to and inclusive of Nov. 15. Some sales for export were made and also some considerable sales to important domestic consumers, including certain galvanizers. The bulk of the business was for January-March delivery, and the nature of the demand was sufficient to produce a considerable advance in price. Since Monday the market has been dull and quiet, and a shade weaker in tone.

The Donora plant of the United States Steel Corporation is now producing spelter regularly, and its output will increase month by month, but it will probably not be running at full capacity before next April.

Zinc Sheets were advanced 1c. per lb. on Nov. 13, to $18 per 100 lb. On Nov. 17 the price was again advanced 1c., making it $19 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

DAILY PRICES OF METALS IN NEW YORK

Nov.	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
11	4.6525	50¼	17.90 @18.05	38¾	5.15	5.07½	14.25 @15.75
12	4.6538	50¼	18.00 @18.15	43	5.15 @5.17½	5.07½ @5.10	14.25 @15.75
13	4.6500	50¼	18.15 @18.30	44	5.15 @5.20	5.07½ @5.10	14.50 @16.00
15	4.6525	50¾	18.20 @18.55	45	5.25	5.17½	15.50 @17.25
16	4.6550	50¾	18.40 @18.80	42	5.25	5.17½	15.50 @17.00
17	4.6663	51	18.75 @18.80	42	5.25	5.17½ @5.20	15.50 @17.00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Nov.	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
11	24 7/16	75½	75⅝	91	18.88	167	166¾	25½	5 21	85½	17.74
12	24 7/16	77½	77⅝	91½	18.98	172	171½	26¼	5 42	87	18.05
13	24 7/16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
15	24⅛	78⅛	78¼	91½	18.97	176¼	175	26¾	5.57	86	17.84
16	24⅛	78¼	78	92	19.09	172¼	171¼	27⅛	5.63	86	17.85
17	24⅛	79¾	79¼	92	19.13	174¼	173¼	27	5.61	86	17.88

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £ 15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21¼c.

Other Metals

NEW YORK—Nov. 17

Aluminum—Supplies for early delivery continue scarce. Prices are fully maintained and even stiffened, 57@59c. having been paid for No. 1 ingots for spot delivery.

Antimony—The market is very firm. Stocks here are low and metal for immediate shipment is hard to get. Quotations for Chinese and other ordinary brands are 37½@38½c. per lb. Cookson's is held at 45c. per lb. nominally.

Antimony ore is only offered in very small quantities, at $2.25@2.35 per unit.

Quicksilver—The market is strong and stocks are small. New York price is $105 per flask of 75 lb. for large lots; $105 @110 for smaller orders. San Francisco reports by telegraph $100 per flask, with the market very firm. London price is £16 10s. per flask, with no discount from second hands.

Nickel—There is no change reported. Ordinary forms are nominally 45@50c. per lb. according to size and terms of order. A premium of 3c. per lb. is changed for electrolytic nickel.

Minor Metals—Current quotations for **Bismuth** are $3 per lb., New York.—**Cadmium** is quoted at 7s. per lb. in London; $1.75@1.90 per lb., New York.—**Chromium** metal, 75c. per lb., New York.—**Cobalt** metal, 97% pure, is sold at $2 per lb.—**Magnesium,** pure, has gone to a high price, $6 per lb. being asked.

EXPORTS AND IMPORTS

Exports and Imports of Copper in September are reported by the Department of Commerce as below, in pounds:

	Imports	Exports
Ore, copper content	10,503,225	315,651
Matte, copper content	1,706,689	.....
Unrefined, blister copper, etc.	25,529,234	2,168
Refined	786,560	49,441,194
Old scrap, etc.	663,658	10,625
Total	39,189,366	49,769,638

In addition to the quantities given, manufactures of copper valued at $631,258 were exported; quantities not being given. This makes the exports of copper for the nine months ended Sept. 30 a total of 216,260 long tons; imports, 106,371 tons.

Imports of Lead in September are reported by the Department of Commerce as below, in pounds:

Lead in ore	1,095,649
Lead in base bullion	10,728,927
Lead, metallic	27,944
Total	11,852,520

The total imports for the nine months ended Sept. 30 were 37,572 short tons. The base bullion was nearly all from Mexico.

Imports and Exports of Zinc in September are reported by the Department of Commerce as below, in pounds:

	Imports	Exports
Zinc contents of ore	8,826,329	1,218,500
Zinc, metallic	225,689	20,332,761
Total	9,052,018	21,551,261
Zinc dust	269,774	78,320
Zinc dross	.....	886,778

Total weight of ore imported was 15,753 tons; 5,112 tons being from Mexico, 5,023 from Australia, 4,743 from Spain, 874 from Canada, and 1 ton from Japan. For the nine months ended Sept. 30 the total exports were 90,696 short tons; imports, 32,416 tons, nearly all in ore.

Exports and Imports of the Principal Metals, other than iron and steel, eight months ended Aug. 31, copper and tin in long tons, lead and zinc in short tons:

	Exports		Imports	
	1914	1915	1914	1915
Copper	284,910	194,041	104,789	87,626
Tin	486	502	28,939	33,576
Lead	46,495	86,059	15,635	34,646
Zinc	4,435	79,920	760	607
Ores:				
Zinc	8,499	605	12,483	77,468
Zinc ore, contents	.....	.....	4,503	31,809

Exports include reëxports of foreign material. Copper includes contents of ore and matte; lead, contents of ore and base bullion.

Shipments of tin from the Straits 10 months ended Oct. 31—estimating October—were 51,127 long tons, in 1914, and 54,060 in 1915; increase, 2,933 tons.

Gold, Silver and Platinum

NEW YORK—Nov. 17

Gold is still coming here from London. A further shipment of $3,800,000 was made on Nov. 12, and more is reported this week.

Platinum continues high, with supplies scarce and the future uncertain. Sales are small, and prices continue rather nominal at $55@60 per oz. for refined platinum; $60@63 per oz. for hard metal.

Our Russian correspondent writes under date of Oct. 22 that the market is very firm and advancing. The demand both for the domestic market and for export has increased enormously, and the offers of metal are not up to the needs of the market. On Oct. 16 a total of five poods was sold at 52,000 rubles per pood. The quotations at Ekaterinburg are 13@13.25 rubles per zolotnik; at Petrograd, 52,000@53,000 rubles per pood, for crude metal, 83% platinum. These prices are equal to $49.35 and $51.45 per oz., average.

Silver has shown a rising tendency the past week, owing to a more active London demand and reduction in the stocks held in that city. The advance in English exchange has also contributed to an improvement in the New York equivalent price of the London official.

Zinc and Lead Ore Markets

JOPLIN, MO.—Nov. 13

Blende, high price $112.50; base per ton 60% zinc, premium ore, $110; medium, $109@100; lower grades down to $90; calamine, base per ton 40% zinc, $60@70; average selling price, all grades of zinc, $97.49 per ton. Lead, high selling price, $62.50, bids today as high as $64 base per ton of 80% metal content; average selling price, all grades of lead, $60.55 per ton.

SHIPMENTS WEEK ENDED NOV. 13

	Blende	Calamine	Lead	Values
Totals this week.	14,307,340	714,090	2,066,750	$794,790
Totals this year.	506,481,690	36,423,080	78,789,770	22,647,380

Blende value, the week, $711,750; 46 weeks, $19,692,000.

Calamine value, the week, $20,490; 46 weeks, $880,230.

Lead value, the week, $62,550; 46 weeks, $2,074,150.

Sellers are very well satisfied with the market for both zinc and lead. Zinc was advanced another $10 this week and lead was advanced $4 per ton today for next week's delivery. The enormous shipment is largely attributable to the United States Smelting, Refining and Mining Co.'s heavy purchases the past three weeks. This week this company was practically out of the market, but this was not known until late in the week by the agents of other smelting companies. Today blende of 62% zinc and no lead was being offered at $105 base, a grade of ore purchased yesterday at $110 base.

PLATTEVILLE, WIS.—Nov. 13

The base price paid this week for 60% grades of zinc ore advanced from $88 to $100 per ton at week end. The base price paid for 80% lead ore was $58 per ton.

SHIPMENTS, WEEK ENDED, NOV. 13

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,738,400	.....	1,790,100
Year	178,771,750	6,028,540	24,862,690

Shipped during week to separating plants, 4,872,000 lb. zinc ore.

Iron Trade Review

NEW YORK—Nov. 17

The iron and steel trades continue extremely active, with both foreign and domestic demand strong and prices inclined to advance still further.

The following statement has been issued: "The United States Steel Products Co. has recalled, temporarily, quotations in French markets, except as to pipe, tinplate, and some specialties that involve a small tonnage, for the reason that steel products for delivery in the near future are sold well up to maximum capacity. Until the general questions of supply and demand are carefully considered it is impossible to tell how much surplus we shall have for sale in France for the present."

The new works of the Steel Corporation at Duluth, Minn., are almost ready to start and will probably be making steel ingots and billets next week.

The United States Steel Corporation announces that two blast furnaces and several openhearth furnaces are to be added to the equipment of the Gary works, and some other improvements.

It appears that the control of the Cambria Steel Co. is not yet decided. We noted last week the sale of 112,000 shares by the Pennsylvania R.R. Co. to W. H. Downer, now president of the Cambria. This week a further sale of 250,000 shares was made to a syndicate represented by J. L. Replogle, formerly vice-president of the Cambria and now president of the Vanadium Steel Co. With him are associated some prominent Philadelphia and Pittsburgh steel men. Neither party now holds a majority of the stock. Reports as to the sale of the Pennsylvania Steel Co. have been current, but have not been confirmed.

Alabama pig-iron production for the 10 months ended Oct. 31 was 1,600,712 tons. The make of iron is now at the rate of about 200,000 tons a month.

The United States Steel Corporation reports unfilled orders on its books Oct. 31 at 6,165,452 tons of material; an increase of 847,834 tons over Sept. 30, and the highest monthly report made since May, 1913, over two years ago.

Exports and Imports of those articles of iron and steel for which tonnages are given in the Commerce reports were as follows for September and the nine months ended Sept. 30, in long tons; values of exports of machinery are added:

	September		Nine Months	
	1914	1915	1914	1915
Imports, iron and steel	38,420	31,814	234,282	183,997
Exports, iron and steel	96,482	381,317	1,142,979	2,461,198
Exports, machinery, values	$5,295,167	$12,377,389	$72,617,657	$91,673,678

Exports of mining machinery, including oil-well machinery for the nine months were valued at $5,934,748 in 1914, and $4,950,076 this year.

FOREIGN IRON

Pig Iron Production in Germany in September was 1,033,078 metric tons, being 17,532 tons less than in August, and 452,991 tons more than in September, 1914. For the nine months ended Sept. 31 the total production this year was: Foundry, 1,776,034; forge, 218,964; steel pig, 1,244,275; bessemer pig, 135,162; Thomas (basic) pig, 5,291,093; total, 8,665,528 tons. The total in 1915 was 12,016,888 tons, showing a decrease of 3,351,360 tons, or 27.7%, this year.

Exports of Iron Ore from Sweden in the six months ended June 30 were 2,027,000 tons, a decrease of 501,000 tons from last year. Imports of coal were 2,243,000 tons, an increase of 108,000 tons from last year.

Imports of Iron and Steel into Italy for the six months ended June 30 were 336,164 tons. Imports of coal were 4,119,110 tons, being 1,285,360 tons less than last year.

British Foreign Trade in Iron and Steel and in manufactures thereof for the nine months ended Sept. 30 are valued by the Board of Trade returns as follows:

	Exports	Imports	Excess
Iron and steel	£28,794,063	£7,844,353	Exp. £20,949,710
Machinery, hardware, etc.	21,842,751	11,377.041	Exp. 10,465,710
Totals	£50,636,814	£19,221,394	Exp. £31,415,420
Totals, 1914	73,204,394	20,526,543	Exp. 52,677,851

Quantities of iron and steel exported were 3,179,726 long tons in 1914, and 2,333,529 tons in 1915. Quantities imported were 1,467,412 tons in 1914, and 901,032 tons this year.

PITTSBURGH—Nov. 16

The October increase of 847,834 tons in the unfilled obligations of the Steel Corporation show the pace at which steel buying has proceeded, for the bookings, although so large, were chiefly of specific orders, there being an unusually small amount of contract tonnage. Only in two months in the past, December, 1911, and October, 1912, was there a larger increase, and in those months the business accepted was chiefly in the form of open contracts, subject to specification later.

This week witnesses a reduction in the pressure to buy steel products, the rush to get under cover having spent part of its force, while it meets increased reserve on the part of the steel mills as to selling. Some are practically out of the market. Very few will accept contract obligations and the trend is strongly toward a condition in which nothing marketwise will be done except by way of specific orders. Specifying against existing contracts shows no abatement. With these specifications and the specific orders placed the mills will enter the new year with from two to four months of actual work on books, according to the description of material, and even very light buying in the first six months of next year will not enable the mills to catch up by July 1. Steel prices continue to show an advancing tendency. The average price of finished steel products is now within $3 a ton of the highest level reached in 1907, and higher than at any high point since then.

The most important new business in sight is in freight cars. The Pennsylvania system is now opening bids on 9,000 cars but is expected to buy a larger number, as many as 25,000 being predicted in some quarters. There are many inquiries for relatively small lots. The railroads are disagreeably surprised at the strength of the steel market, finding that full market prices have to be paid for car material, while the mills will give options for only a few days at a time.

Pig Iron—The sharply advancing tendency in pig iron has been arrested and in bessemer there has been what amounts to a reaction from the higher prices reported a week ago. We quote: Bessemer, $16.50; basic, $16; foundry and malleable, $15.50@16; gray forge, $15@15.50, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Steel—There continues to be buying of billets and sheet bars by mills that ordinarily make steel for their own consumption, the object being to release openhearth capacity to make forging and war billets. The latest buying of this sort has been by the Pittsburgh Steel Co., which has taken about 40,000 tons of bessemer billets from Youngstown and Wheeling mills, to use in its wire department, releasing so much openhearth steel-making capacity for other purposes. Current prices are approximately as follows: Bessemer billets, $25.50@26.50; sheet bars, $26@26.50; openhearth billets, $26.50@27.50; sheet bars, $27@27.50, at maker's mill, Pittsburgh or Youngstown; forging billets, $42@45; rods, $35 at mill.

IRON ORE

Shipments to furnaces from Lake Erie docks have been large, and the stock on docks is being drawn down rather low. Some furnaces which have been looking for additional tonnage this year have not been able to get it.

Of the October shipments of Lake Superior ore a total of 5,741,176 tons, or 80.3%, were delivered to Lake Erie docks.

Imports at Baltimore for the past week included 23,958 tons manganese ore from Brazil.

Imports at Baltimore included 35,775 tons iron ore, of which 5,785 tons were from Algeria and 29,990 tons from Cuba.

OTHER ORES

Molybdenium and Tungsten ores mined in Australia are now all taken by the Commonwealth government under an agreement with the British government. No exports of these ores will be allowed except through the government agents, Dalgety & Co., Ltd. The arrangement is for one year from Sept. 9, 1916. The prices fixed by the government are: Molydenite, 90% MoS_2, 105s.—$25.20—per unit; Wolframite, 65% WO_3, or scheelite, same grade, 55s.—$13.20—per unit.

Prices here are a decided contrast to these. We noted last week a sale of **Tungsten** ore at $38 per unit, and have since heard of sale of ore, 60% WO_3 at $45 per unit.

NEW CALEDONIA ORES

Shipments of chrome ore from New Caledonia in August were 11,195 metric tons, all to the United States. For the eight months ended Aug. 31 shipments were 40,024 tons chrome ore and 39,216 tons nickel ore. Shipments of nickel matte were 2,710 tons.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 424,162 short tons; shipments, 426,093 tons. Shipments of Greensburg and Upper Connellsville districts, 45,022 tons.

Connellsville—The market for prompt furnace coke is decidedly softer, with fair offerings at $2.25 and little demand. Corrigan, McKinney & Co. are understood to have closed for at least half their requirements for 1916 with the Rainey interest. The Youngstown Sheet and Tube Co. is reported to have renewed its contracts, involving a total of about 75,000 tons a month, with Hillman and Producers, for the first three months of 1916 at about $2.50, this carrying the company to the time when its new byproduct plant is expected to be operating. Foundry coke is quotable at $3@3.25 for both prompt and first-half contracts.

Chemicals

NEW YORK—Nov. 17

The general markets show little change from our last report. The chief business now is in contracts for next year's delivery of heavy chemicals.

Arsenic—Only a moderate business is forward. Prices are steady and unchanged at $3.75@4 per 100 lb. for both spot and futures.

Copper Sulphate—Business is good for the season and the market is steady. Current quotations are $7 per 100 lb. for carload lots and $7.25 per 100 lb. for smaller parcels.

Nitrate of Soda—The market is rather active and sales are steady. Quotations are firm at $2.90 per 100 lb. for spot and December; and $2.85 per 100 lb. for January and later deliveries.

Imports and Exports of Raw Materials for chemical manufacture in the United States eight months ended Aug. 31, in long tons:

	Imports		Exports	
	1914	1915	1914	1915
Sulphur	14,583	17,736	95,176	9,414
Pyrites	667,036	600,558	.....	150
Chrome ore	48,081	30,089	.....	.....
Magnesite	90,522	19,287	1,196	412

Exports include reëxports of foreign material. Estimating sulphur contents of pyrites, the total imports of sulphur in 1915 were 257,958 tons.

Assessments

Company	Delinqe	Sale	Amt.
Blue Bull Reorg., Nev	Nov. 1	Dec. 6	0.01
Coeur d'Alene Inv., Ida	Oct. 25	Dec. 6	0.002
Columbus Ext., Utah	Dec. 11	Jan. 3	0.02
Cons. Imperial, Nev	Nov. 30	Dec. 21	0.01
Copper Mt. M. & D., Ida	Oct. 28	Dec. 1	0.002
Danley-Lloyd, Utah	Nov. 14	Nov. 30	0.0025
Darby M. & M., Ida	Nov. 16	Dec. 16	0.00125
Dry Canon Cons., Utah	Dec. 18	Jan. 17	0.001
Eastern Star, Ida	Oct. 29	Nov. 29	0.002
Emerald Oil, Utah	Nov. 27	Dec. 16	0.06
Eureka M. & M., Ida	Nov. 26	Dec. 27	0.001
Great Western, Nev	Nov. 15	Dec. 7	0.001
Hancock Cons., Mich	Jan. 3		1.00
Hector, Ida	Nov. 18	Dec. 10	0.005
Idaho & Los Angeles, Ida	Nov. 26	Dec. 27	0.005
Idaho-Nevada Exp., Ida	Nov. 1	Dec. 1	0.002
Ivanhoe, Ida	Nov. 8	Dec. 9	0.0025
Jack Waite, Ida	Nov. 20	Dec. 20	0.01
Leonora M. & M., Utah	Nov. 27	Dec. 17	0.005
Lewis & Clark, Ida	Oct. 15	Nov. 15	0.001
Lucky Swede, Ida	Nov. 11	Dec. 11	0.002
Military M. & M., Ida	Oct. 28	Nov. 29	0.0065
Missoula Copper, Ida	Nov. 15	Dec. 15	0.002
Montana Standard	Nov. 15	Dec. 15	0.005
National Copper, Ida	Nov. 20	Dec. 18	0.01
National Lead, Ida	Nov. 15	Dec. 15	0.001
Nevada-Douglas, Nev	Nov. 30	Dec. 31	0.10
New Arcadian, Mich	Dec. 1		0.50
New Baltic, Mich	Jan. 15		0.50
Northern Light, Ida	Nov. 2	Dec. 2	0.004
O. K. Ex. M. & R., Utah	Nov. 20	Dec. 15	0.005
Old Vetearn, Ida	Nov. 1	Nov. 27	0.002
Oom Paul Con., Ida	Nov. 16	Dec. 6	0.01
Oriental, Nev	Nov. 6	Dec. 7	0.003
Original, Nev	Nov. 6	Dec. 7	0.003
Pacific M. & M., Ida	Nov. 10	Nov. 30	0.0005
Phedora, Ida. (post.)		Nov. 20	0.0005
Phoenix, Mich	Jan. 1		1.00
Pioche Metals, Nev	Oct. 20	Nov. 20	0.00½
Rainbow, Ida	Oct. 15	Nov. 20	0.002
Seg. Belcher & Midas, Nev	Dec. 12	Jan. 6	0.02
Silver Cliff, Ida	Nov. 8	Dec. 6	0.0025
Silver Pick Cons., Nev	Oct. 16	Nov. 23	0.01
Sonora M. & M., Ida	Nov. 4	Dec. 17	0.003
Sunset M. & D., Nev	Oct. 18	Nov. 22	0.02
Ton. Gipsy Queen, Nev	Oct. 29	Dec. 6	0.01
Umatilla Ton., Nev	Nov. 8	Dec. 13	0.005
Wolf Mountain, Utah	Nov. 12	Dec. 14	0.0025

Stock Quotations

The copper and lead stocks have advanced sensationally this week, and apparently the end is not in sight. Coppers always look best with the metal at 20c. per lb.

COLO. SPRINGS	Nov. 16	SALT LAKE	Nov. 16
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	.02½	Beck Tunnel	.05½
Cripple Cr'k Con.	.008	Black Jack	.05
C. K. & N.	‡.02	Colorado Mining	.06
Doctor Jack Pot	.09½	Crown Point	.01
Elkton Con	.30	Daly-Judge	7.10
El Paso	.77	Emma Cop	.24½
Findlay	.03½	Gold Chain	.10
Gold Dollar	.02½	Grand Central	.46
Gold Sovereign	.05½	Iron Blossom	.82
Golden Cycle	1.81	Lower Mammoth	.05½
Isabella	.18½	May Day	.18½
Jack Pot	.06½	Opohongo	.00½
Jerry Johnson	.05½	Prince Con	.77
Lexington	‡.005	Seven Troughs	.01½
Mary McKinney	.44	Silver King Coal'n	3 25
Pharmacist	‡ 008	Silver King Con	2.10
Portland	1.70	Sioux Con	.02
Raven B. H.	.03½	Uncle Sam	.07½
Vindicator	1.65	Yankee	.34

TORONTO	Nov. 16		
Bailey	.04½	Dome Exten	.28
Chambers Ferland	.16	Dome Mines	24.87½
Conlagas	4.00	Foley O'Brien	.50
Peterson Lake	.26½	Hollinger	26.50
Right of Way	‡.04	Imperial	.04½
Seneca Superior	.65	Jupiter	.11½
Silver Queen	‡.01	McIntyre	.60
T. & Hudson Bay	20.00	Pearl Lake	‡.00½
Timiskaming	.44	Porcu. Crown	.78
Trethewey	.13	Preston E. D.	.04½
Wettlaufer-Lor	.07	Vipond	.74

SAN FRANCISCO	Nov. 16		
Alta	.04	Belmont	3.70
Andes	.09	Jim Butler	.90
Best & Belcher	.06	Lone Star	.03
Caledonia	.52	MacNamara	.02
Challenge Con	.06	Midway	.11
Chollar	.02	Mont.-Tonopah	.29
Confidence	.16	North Star	12.00
Con. Virginia	.23	Rescue Eula	.06
Gould & Curry	.03	West End Con	.66
Hale & Norcross	.04	Atlanta	.22
Jacket-Cr. Pt	.17	Blue Bell	.02
Julia	.02	Booth	.36
Mexican	.39	C.O.D. Con	.04
Occidental	.75	Comb. Frac	.07
Ophir	.30	D'field Daisy	‡.03
Overman	.09	Jumbo Extension	1.27½
Potosi	.02	Pitts.-Silver Peak	‡.06
Savage	.05	Round Mountain	.41
Sierra Nevada	.50	Sandstorm Kendall	.09½
Union Con	.51	Silver Pick	.07
Utah Con	.03	Central Eureka	.08

N. Y. EXCH.	Nov. 16	BOSTON EXCH	Nov. 16
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Juneau	12	Adventure	2
Am.Sm.&Ref.,com	100	Ahmeek	397
Am. Sm. & Ref., pf.	111½	Alaska Gold M	29
Am. Sm. Sec., pf. A	90½	Algomah	1½
Am. Sm. Sec., pf. B.	84½	Allouez	59
Anaconda	91½	Am. Zinc	70
Batopilas Min	1⅛	Ariz. Com., ctfs.	7½
Bethlehem Steel	459¾	Bonanza	.30
Bethlehem Steel, pf.	460½	Butte-Balaklava	3
Chino	53½	Butte & Superior	71½
Colo. Fuel & Iron	54½	Calumet & Ariz	69½
Crucible Steel	75½	Calumet & Hecla	563
Federal M. & S., pf.	53½	Centennial	18
Great Nor., ore., ctf.	50½	Copper Range	62½
Greene Cananea	42½	Daly West	2½
Guggen. Exp	78½	East Butte	15½
Homestake	121	Franklin	10½
Inspiration Con	46½	Granby	85
International Nickel	194	Hancock	17
Miami Copper	35½	Hedley	28
Nat'l Lead, com	66⅜	Helvetia	.40
National Lead, pf.	114	Indiana	5½
Nev. Consol.	16½	Island Cr'k, com	43
Ontario Min	4½	Island Cr'k, pfd	89
Quicksilver	4½	Isle Royale	28½
Itay Con	27⅛	Keweenaw	2½
Republic I&S, com	52½	Lake	13½
Republic I&S, pf.	107½	La Salle	6
SlossSheffi'd, com	59	Mason Valley	1⅝
Tennessee Copper	59½	Mass	13
Utah Copper	79	Mayflower	4½
U. S. Steel, com	86⅜	Michigan	2½
U. S. Steel, pf.	115½	Mohawk	87⅜
		New Arcadian	11⅛
N. Y. CURB	Nov. 16	North Butte	32½
Alta Con	.12	North Lake	1½
Beaver Con	.30	Ojibway	1⅛
Big Four	.05	Old Colony	3½
Braden Copper	16½	Old Dominion	58½
Buffalo Mines	.30	Osceola	87
Can. Cop. Corpn	2 3/16	Quincy	89½
Cashboy	.05	Santa Fe	4
Cerrode Pasco	39½	Shannon	8½
Chile Cop	25½	Shattuck-Ariz	37½
Con. Ariz. Sm	1⅛	Superior	28½
Con. Coppermines	1⅛	Superior & Bost	2½
Con. Nev.-Utah	4/16	Tamarack	56
Dia. Black B	.03	Trinity	11½
Florence	.42	Tuolumne	.35
Goldfield Con	1 4/16	U. S. Smelting	47½
Goldfield Merger	.20	U. S. Smelt'g, pf.	47½
Howe Sound	3½	Utah Apex	3½
Kennecott Cop	58½	Utah Con	13½
Kerr Lake	3⅛	Victoria	2½
La Rose	.75	Winona	3½
Magma	15⅛	Wolverine	60
McKinley-Dar-Sa	.35	Wyandot	1½
Mines of Am	2½		
Mother Lode	.34	BOSTON CURB	Nov. 16
Nevada Hills	.18	Bingham Mines	8
New Utah Bingham	3	Boston Ely	.21
Nipissing Mines	7½	Butte & Lon'n Dev.	.41
Oro	.06	Calaveras	1½
St. Joseph Lead	14⅜	Calumet-Corbin	.03
South Utah	.30	Chief Con	.96
Stand'd Oil of N.J.	495	Cortez	.45
Standard S. L.	1⅜	Crown Reserve	.55
Stewart	.50	Davis-Daly	1 5/16
Success	.62	Eagle & Blue Bell	1 1/16
Tonopah	5⅜	First Nat. Cop	5½
Tonopah Ex	3	Houghton Copper	3
Tonopah Merger	.42	Iron Cap Cop., pf.	7
Tribullion	.75	Majestic	.75
Yukon Gold	4⅛	Mexican Metals	.37
		Nevada-Douglas	.61
LONDON	Nov. 4	New Baltic	3½
Alaska Tre'dwell	£6 17s 6d	New Cornelia	9½
Burma Corp	1 8 9	Ohio Copper	.15
Cam & Motor	0 13 6	Oneco	1
Camp Bird	0 8 0	Raven Copper	.10
El Oro	0 10 6	Rex Cons	.45
Esperanza	0 12 0	Smokey Dev	.15
Mexico Mines	4 5 0	So. Lake	5½
Nechi, pfd	0 13 0	Tonopah Victor	.30
Oroville	0 14 3	United Verde Ext.	5½
Santa Gert'dis	0 10 6	Utah Metal	9½
Tomboy	1 3 0		
Tough Oakes	0 7 0	‡Last Quotations.	

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.493	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175	49.915	27.825	26.704	23.570
June	58.990	56.471	49.034	27.199	25.948	23.267
July	58.721	54.678	47.519	27.074	25.219	22.597
August	59.293	54.344	47.163	27.335	25.979	22.780
September	60.640	53.290	48.680	27.986	24.260	23.591
October	60.793	50.654	49.385	28.083	23.199	23.925
November	58.995	49.082	.....	27.263	22.703	.....
December	57.760	49.375	.....	26.720	22.900	.....
Year	59.791	54.811	.....	27.576	25.314	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.096	69.313	*
May	13.996	18.506	63.182	77.600	67.786	*
June	13.603	19.477	61.336	82.574	66.274	95.333
July	13.223	18.796	60.540	76.011	64.955	91.409
August	*	16.941	‡	68.673	‡	82.333
September	*	17.502	‡	68.915	‡	85.250
October	*	17.686	‡	72.601	‡	88.000
November	11.739	.....	53.227	.....	*	.....
December	12.801	.....	56.841	.....	*	.....
Year	.....	.....	.....	.....	.....	.....

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577	40.288	138.321	167.636
July	31.707	37.423	142.517	167.080
August	*	34.389	‡	151.440
September	32.675	33.125	‡	152.625
October	30.284	33.080	‡	151.554
November	33.304	.....	139.391	.....
December	33.601	.....	147.102	.....
Av. year	34.301	.....	.....	.....

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	5.659	3.738	5.531	19.051	24.611
August	3.875	4.656	3.715	4.520	‡	21.946
September	3.828	4.610	3.658	4.490	‡	23.151
October	3.528	4.600	3.384	4.499	‡	23.994
November	3.683	.....	3.585	.....	18.500	.....
December	3.800	.....	3.662	.....	19.097	.....
Year	3.862	.....	3.737	.....	.....	.....

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5.074	14.781	4.924	14.610	21.393	68.100
June	5.000	21.208	4.850	21.038	21.345	100.614
July	4.920	19.026	4.770	18.856	21.568	97.250
August	5.568	12.781	5.418	12.611	‡	67.786
September	5.380	13.440	5.230	13.270	‡	67.841
October	4.909	12.800	4.750	12.596	‡	66.536
November	5.112	.....	4.962	.....	25.016	.....
December	5.592	.....	5.430	.....	27.369	.....
Year	5.213	.....	5.061	.....	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15 07	14.55	13.91	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.13	13.95
May	14.90	14.61	13 90	13.60	14.27	13.83
June	14.90	14.70	13.90	13.67	13.96	13.77
July	14.90	14.94	13.90	13.91	13.90	13.68
August	14.90	16.01	13.90	15.31	14.08	14.75
September	14.90	16.86	13.90	15.95	14.03	15.70
October	14.84	16.95	13.75	15.96	13.97	15.80
November	14.59	.....	13.43	.....	13.83	.....
December	14.70	.....	13.45	.....	13.83	.....
Year	$14.88	.....	$13.78	.....	$14.01	.....